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BALD (J. G.). **The use of numbers of infections for comparing the concentration of plant virus suspensions. II. Distortion of the dilution series.**—*Ann. appl. Biol.*, xxiv, 1, pp. 56–76, 2 graphs, 1937.

Continuing his studies in this series [*R.A.M.*, xvi, p. 495, and next abstract], with particular reference to the distortions in the dilution experiments, the author distinguishes between the types of infection-dilution series given by unpurified samples of viruses of the tobacco mosaic group and by viruses less resistant to loss of virulence, namely, potato virus X, tobacco ring spot, tobacco necrosis, cucumber mosaic, and tomato spotted wilt. It was shown that in the series for the tobacco mosaic group, when the inocula were diluted with distilled water or buffered near the neutral point, distortion existed more in the concentrated than in the dilute end of the series, and that the form of the series was changed when the hydrogen-ion concentration was acid; the addition of healthy plant juices to the inocula tended to produce two opposing effects on the production of local lesions, namely, a stimulation and a depression. While the causes of these tendencies are difficult to decide, it is suggested that the depressing effect may be assumed to be due partly to the destruction of possible entry points, and partly to the adsorption of virus particles by impurities. In the series for the less resistant viruses, the distortions (low values) occurred at high dilutions. The addition of concentrations of the order of 0·01 and 0·1 *M* of neutral potassium phosphate-phthalate buffer to unpurified suspensions of X virus depressed the numbers of lesions produced, while when added to purified samples of this virus, the buffer produced high values for lesions at a concentration of about 0·00005 *M*, low values between 0·0001 and 0·001 *M*, a maximum between 0·001 and 0·01 *M*, and a decline at higher concentrations. It is tentatively suggested, to explain the effects of salts on the production of lesions by virus X, that the virus particles tend to aggregate in groups not readily dissociating on dilution, and that the electrolyte content affects the degree of aggregation. The time and probability of the appearance of symptoms after inoculation depends on the massiveness of inoculation, the likelihood of positive infection being high when a single large aggregate or a number of aggregates enter at one point, and low when entry is effected by single small aggregates.

BALD (J. G.). **The use of numbers of infections for comparing the concentration of plant virus suspensions. III. The effect of carbon on the production of lesions by viruses of the Tobacco mosaic group.**—*Ann. appl. Biol.*, xxiv, 1, pp. 77–86, 1 graph, 1937.

In this, the third paper of this series [see preceding abstract], the author describes experiments in which the spreading power was compared of distilled water, suspensions of plant juice, suspensions of finely divided carbon (lamp black), and of a commercial spreader. The results showed that the contact angle of the plant juice and commercial spreader suspensions was lower than that of water and of carbon suspensions, and that when rubbed on the surface of *Nicotiana glutinosa* leaves and on paraffin wax surfaces the plant juice and the spreader gave good contact compared with the distilled water; when treated in the same way, the carbon particles in the carbon suspensions adhered to the surfaces, carrying with them a film of water. The effect of carbon and of plant juice, observed by the author and certain other workers, in raising the number of infections when present in plant virus inocula, may thus be explained by the better contact of the inoculum with the leaf surface. When added in uniform amounts to a number of dilutions of purified suspensions of viruses of tomato streak, aucuba mosaic, and ordinary tobacco mosaic, lamp black caused an equal rise in the number of lesions produced on *N. glutinosa* leaves, but when the lamp black was diluted in the same ratio as the viruses, the effect was decreased. The rise given by carbon was shown to be largely a function of the leaf tissues, probably of the nature of the leaf surface, since differences were observed between plants and between leaves of the same plant.

LORING (H. S.) & STANLEY (W. M.). **Isolation of crystalline Tobacco mosaic virus protein from Tomato plants.**—*J. biol. Chem.*, cxvii, 2, pp. 733–754, 1 fig., 1937.

This is an expanded, fully tabulated account of the writers' experiments in the isolation of a crystalline tobacco mosaic virus protein [see next abstracts] from diseased Bonny Best tomato plants, a preliminary note on which has already been published [*R.A.M.*, xv, p. 404]. The most active material was yielded by young, rapidly growing greenhouse plants subjected to a procedure involving a minimum amount of treatment with celite. The proteins from both hosts were shown to possess the same infectivities, serological properties, isoelectric points, sedimentation constants, and almost the same solubilities. Repeated fractionation of the virus protein with celite at P_H 4·5 and 8 results in its gradual inactivation, but it retains its solubility and may still be crystallized. It was shown by other fractionation experiments, in which up to 81 per cent. of the original sample was lost in the course of 15 re-crystallizations, that the remaining crystals were equally virulent with those constituting the original material. A comparison of the relative infectivities of the juices of diseased tobacco and tomato plants on a total protein basis indicates, in agreement with the percentage yields of crystalline virus protein isolated, that the tobacco mosaic virus reaches a higher concentration in tobacco than in tomato plants.

STANLEY (W. M.). **Chemical studies on the virus of Tobacco mosaic. IX. Correlation of virus activity and protein on centrifugation of protein from solution under various conditions.**—*J. biol. Chem.*, cxvii, 2, pp. 755–770, 1937.

Ultra-centrifugation of solutions of mixtures of ordinary tobacco and aucuba mosaic virus proteins and tobacco proteins, egg albumin, trypsin, and pepsin, respectively, resulted in the sedimentation of the high molecular weight virus protein in the form of a crystalline mass at the bottom of the tube and in the concentration of the virus activity, gauged by the number of lesions produced by inoculation into half-leaves of *Phaseolus vulgaris* and *Nicotiana glutinosa*, in this protein mass [*R.A.M.*, xvi, p. 417]. The supernatant liquids containing the low molecular weight proteins were found to possess practically no virus activity, which is evidently not due, therefore, to an agent separable from the high molecular weight protein and transferable to others.

When the virus proteins were centrifuged at their isoelectric points, or when negatively or positively charged virus protein ions were centrifuged from solution on an angle centrifuge so that the upper portion of the supernatant liquids contained 5 to 15 per cent. of the original protein, the virus activity of different portions of the centrifuged preparations was proportional to the amount of high molecular weight protein present. Ultra-centrifugation of over 99·9 per cent. of the high molecular weight virus protein from solution yielded a supernatant liquid with an activity approximately proportional to the protein remaining in solution. These data are considered to indicate that the virus and the protein are identical, the activity of the former being a specific property of the high molecular weight protein.

LORING (H. S.) & STANLEY (W. M.). **Comparative properties of virus proteins from a single-lesion strain and from ordinary Tobacco-mosaic virus.**—*Phytopathology*, xxvii, 2, pp. 134–135, 1937.

Tobacco plants infected with virus derived from ordinary mosaic by several passages in *Nicotiana glutinosa* by means of single necrotic lesions develop typical mosaic symptoms. The treatment of such plants by the procedure used for the isolation of virus protein [see preceding abstracts] produces a crystalline preparation differing in certain minor particulars from that yielded by the ordinary tobacco mosaic virus. The crystals of the former, for instance, are somewhat longer and narrower than those of the latter; the single-lesion virus protein, moreover, has a higher sedimentation constant, is less soluble, and more homogeneous (judged by solubility determinations and ultra-centrifugal analysis) than the ordinary tobacco mosaic virus.

JOHNSON (J.). **Factors relating to the control of ordinary Tobacco mosaic.**—*J. agric. Res.*, liv, 4, pp. 239–273, 7 figs., 1937.

After referring to a previous communication on the inactivation and survival of the ordinary tobacco mosaic virus (tobacco virus 1) in soil [*R.A.M.*, xv, p. 532], the author gives a full account of experiments (local lesion tests on a tobacco hybrid (*Nicotiana tabacum* × *N. glutinosa*) especially suitable for such work) on the survival of the virus in dead

host tissues outside the soil, in an attempt to explain the development of the disease in the field in relation to cultural practices and weather conditions [see next abstract]. The tabulated results showed that the virus in refuse from harvested tobacco, and also in field refuse, may be largely inactivated when exposed to weathering and decay for five or six months, inactivation being greatly promoted by desiccation of the refuse at a relatively early stage of decay. Inside the host roots buried in the field the virus was shown to survive in high concentration up to the next planting season; when closely associated with soil, the virus survived as long as two years in the absence of freezing and desiccation. Certain brands of cigar and cigarette tobacco were found to carry fairly high concentrations of the virus, but other commercial tobacco forms carried little or none at all.

The investigations indicated further that while little, if any, infection occurs through the host roots, the stems and leaves may be infected from several sources, and most commonly from the soil; although direct infection from this source may rarely exceed 25 per cent., subsequent spread from plant to plant by various cultural practices accounts for the high percentages of mosaic sometimes observed. Evidence was also obtained that rain and wind storms play a part in the dissemination of the disease in the field.

In a discussion of the application of these findings to the control of mosaic, it is pointed out that practically the problem may be reduced to the determination and reduction of the important potential sources of infection; once, however, considerable primary infection has become established, further spread is often unavoidable under practical field conditions.

LEHMAN (S. G.). **Contaminated soil in relation to the epiphytology of Tobacco mosaic.**—Abs. in *Phytopathology*, xxvii, 2, p. 133, 1937.

In continuation of previous experiments to determine the relation of contaminated soil to the epiphytology of tobacco mosaic [in North Carolina: *R.A.M.*, xiii, p. 729 and preceding abstract], four plots were laid out in a field of Norfolk sandy loam. Two were in tobacco in 1935, nearly 100 per cent. of the plants being affected by mosaic; the entire diseased crop was disked into the soil at the end of the growing season. The other two plots were in maize in 1935. Healthy plants were set on all the plots in 1936. Up to topping time, no mosaic developed on the tobacco following maize and only 0·65 per cent. on that preceded by the mosaic crop. Some additional mosaic developed after topping, probably due in the main to accidental handling of infected material during the operations. These results confirm those of earlier investigations as to the negligible extent of the damage caused by the direct passage of mosaic into tobacco plants even from heavily contaminated soil.

CLAYTON (E. E.). **Spraying as a method of control for mildew (Peronospora tabacina) and wildfire (Bacterium tabacum) in Tobacco plant beds.**—Abs. in *Phytopathology*, xxvii, 2, p. 124, 1937.

Tobacco [downy] mildew (*Peronospora tabacina*) [*R.A.M.*, xvi, p. 284 and next abstract] is stated to have been reduced to negligible propor-

tions, and wildfire (*Bacterium tabacum*) [ibid., xvi, p. 68] almost completely controlled in five years' (1932 to 1936) experiments in the United States by a combination of early weekly Bordeaux sprays followed at a later stage by semi-weekly applications of a copper oxide-cottonseed oil mixture.

HENDERSON (R. G.). **Histological studies of infection and sporulation of Peronospora tabacina in Tobacco seedlings.**—Abs. in *Phytopathology*, xxvii, 2, p. 131, 1937.

On greenhouse tobacco seedlings the conidia of *Peronospora tabacina* [see preceding abstract] germinate on the leaf surface and directly penetrate the epidermis. A slight enlargement, possibly representing an incipient appressorium, is formed at the end of the germ-tube coming into contact with the leaf surface. A small hyphal strand is pushed through the upper wall of the epidermal cell, within which an enlarged hypha develops and usually sends out haustoria into the surrounding cytoplasm and adjacent cells. On reaching the inner cell wall the enlarged hypha or one of its branches, forms another enlargement and traverses the cell wall by means of a small hyphal strand and arrives at the intercellular spaces of the mesophyll. Similarly, the germ-tube may penetrate a leaf-hair cell and the hypha pass from cell to cell until the mesophyll is reached. Conidiophores may arise from the stomata on either leaf surface, but are restricted to the lower one under average moisture conditions. Conidiophores bearing conidia have been observed entirely embedded in the spongy parenchyma.

IMLE (E. P.) & SAMSON (R. W.). **Studies on a ring-spot type of virus of Tomato.**—Abs. in *Phytopathology*, xxvii, 2, p. 132, 1937.

Tomatoes in many parts of Indiana are affected by a disease characterized by intricate patterns of brown, necrotic rings and lines on the young foliage, broad, sunken, necrotic streaks on the petioles and stems of young shoots, necrosis of shoot terminals, and often corky, brown, necrotic rings on green and ripe fruits. The symptoms suggest the name 'tomato ring spot'. Infected plants may recover from the disease while retaining the virus in an active form. The severity of the disorder was intensified by high temperatures. Mechanical transmission of the ring spot virus was readily effected from tomato to Jimson weed [*Datura stramonium*] by means of carborundum abrasive, but transmission back to tomato was practicable only by grafting, or by passage from *D. stramonium* to tobacco and thence to tomato. The thermal death point of the virus was found to lie between 56° and 58° C.; it was inactivated by 21 to 27 hours' ageing *in vitro* at room temperature, and rendered completely non-infectious by dilutions of 1 in 500. The ring spot virus was communicated to, and recovered from, 14 Solanaceae and one member of the Amaranthaceae.

AZEVEDO (N.). **Observaçoes sobre uma doença de virus em Tomateiro.** [Observations on a virus disease of the Tomato.]—*Rodriguésia*, ii, 6, pp. 209–212, 7 pl., 1936. [Received May, 1937.]

A very brief account is given of a diseased condition, believed to be due to a virus, which was observed in the 'Grande liso' tomato variety

in an experimental field at Itatiaya, Brazil. The main symptoms are a rolling inwards of the mature leaves, and a crinkling and rosette-like deformation followed by wilting and rotting of the apical growth. The main veins of the rolled-up leaves often show a violet discoloration which also almost invariably occurs in the secondary veins of crinkled leaves, being most pronounced at the margins and gradually fading off towards the main veins. Fruits on diseased plants develop various types of spots, among which those in the form of concentric rings, closely resembling the American ring spot, are the most common; other spots may be irregular in shape and more or less covered with crusts of necrotic tissue, which render the fruit unmarketable; occasionally the spot appears as an equatorial zone around the tomato, slightly depressed, and covered with crusts. The disease differs from spotted wilt in that the leaves never exhibit ring spots nor the bronzing typical of spotted wilt, streak, and crinkle.

GARDNER (M. W.), TOMPKINS (C. M.), & THOMAS (H. R.). **Factors affecting the prevalence of the spotted wilt virus.**—Abs. in *Phytopathology*, xxvii, 2, p. 129, 1937.

Localities in the United States characterized by mild winters, no summer rainfall, and the continuous presence of living hosts of the spotted wilt virus [*R.A.M.*, xv, p. 182; xvi, p. 367] appear to constitute endemic infection foci whence considerable spread of the disease by thrips may take place during the spring and summer. The virus is least abundant just after the winter rains, possibly owing to a reduction in the insect population. It may be harboured by certain common winter weeds, such as mallow [*Malva*] and chickweed [*Stellaria media*], in addition to various ornamentals and winter crops. The occurrence of spotted wilt in regions at a distance from infection foci is frequently traceable to the introduction of the virus with imported transplants. In regions where the disease is prevalent, a lower percentage of infection occurs in celery, celeriac, spinach, peas, endive, and chicory than in tomato, pepper [*Capsicum annuum*], and lettuce [ibid., xv, p. 737], while onions, rhubarb, beets (fodder and sugar), chard [*Beta vulgaris* var. *cicla*], globe artichoke [*Cynara scolymus*], carrots, parsley, beans (*Phaseolus*), crucifers, and cucurbits are apparently immune, and potatoes, though susceptible [ibid., xv, p. 538], seem to escape attack.

FOSTER (A. C.). **Environmental factors influencing the development of blossom-end rot of Tomatoes.**—Abs. in *Phytopathology*, xxvii, 2, pp. 128–129, 1937.

It was observed in the course of a four-year study on the relation of environmental factors to blossom-end rot of tomatoes [*R.A.M.*, xvi, p. 421] that plants grown continuously in soil with a low moisture content are resistant to the disease, presumably on account of their hardened state. On the other hand, plants grown under optimum soil-moisture conditions uniformly develop blossom-end rot after exposure to drought. Increasing amounts of nitrogen are apparently conducive to the occurrence of blossom-end rot when other conditions favour the disorder, the incidence of which is markedly reduced, on the contrary, by augmented applications of phosphate. When other conditions are

favourable temperature is not a factor in the development of blossom-end rot, which often occurs at mean temperatures of 65°, 70°, or 75° F. There is stated to be no connexion, moreover, between the disorder and the water requirements of the plants.

BAVENDAMM (W.). **Vierjahresplan und Holzschutz.** [The four-year plan and wood protection.]—*Angew. Bot.*, xix, 1, pp. 1–18, 1937.

In connexion with the German four-year plan the writer outlines the principal measures calculated to render the country self-supporting in respect of timber production. An important step in this direction consists in prolonging the durability of the raw product by rational methods of impregnation, making use of such indigenous materials as fluorides, arsenates, nitrated phenols, and zinc salts in preference to mercury compounds (of foreign origin) or coal-tar oil (utilizable for locomotion and heating). Some interesting statistics are cited in support of this campaign.

BAVENDAMM (W.). **Aus der Praxis der mykologischen Holzschutzmittelprüfung. II. Mitteilung. Arsenhaltige Mittel.** [On the practical aspect of the mycological testing of timber preservatives. Note II. Arsenic-containing preparations.]—*Angew. Bot.*, xix, 1, pp. 18–42, 1937.

Continuing his practical observations on the technique of mycological tests of timber preservatives [*R.A.M.*, xv, p. 546], the writer discusses some recent experimental work by himself and others which strongly emphasizes the importance of selecting for such trials fungi relatively insensitive to the particular poison to be used. Failure to observe this precaution is considered to be largely responsible for the misleading statements constantly appearing with regard to the efficacy of certain inadequately tested preparations. To cite a recent instance, the results set forth by O. Günther in his thesis: Der Holzschutz und seine Bedeutung für die deutsche Volkswirtschaft., Berlin, 1936 (Verlag W. Knapp, Halle a. S.), are to some extent invalidated by his use of the highly sensitive *Coniophora cerebella* [*C. puteana*] for experiments with arsenic-containing preparations, including thanalith U [*R.A.M.*, xvi, p. 430]. Günther's favourable opinion of the last-named cannot be altogether confirmed by the writer on the basis of his tests of basilit U A (stated to be closely similar in composition to thanalith U) with the extremely insensitive *Lenzites abietina* [ibid., xvi, p. 292]. A marked tendency to leaching-out is a disadvantage of basilit U A which should be remedied before placing this material among the preservatives of recognized efficacy.

KÜRBIS (P.). **Mykologische Untersuchungen über den Wurzelbereich der Esche (Fraxinus excelsior L.).** [Mycological investigations on the rhizosphere of the Ash (*Fraxinus excelsior* L.).]—*Flora, Jena, N.F.*, xxxi, 2, pp. 129–175, 11 figs., 6 graphs, 1937.

The examination, during the winter of 1933–4, the autumn of 1934, and the summer of 1935 at the Hann. Münden Silvicultural Institute, of the rhizosphere of ash (*Fraxinus excelsior*) specimens from various parts of Germany revealed no mycorrhizoid elements in the true sense,

but a number of 'companion fungi' [*R.A.M.*, xv, p. 520] were isolated in pure culture on biomalt agar and other media, of which the most constant were *Cylindrocarpon radicicola* [ibid., xv, p. 605] and fungus imperfectus I (*Rhizoctonia sylvestris*) [ibid., xiv, p. 187]; in addition to these may be mentioned *C. didymum*, *Trichoderma koningi* [ibid., xv, p. 257], fungus imperfectus II (probably *Cladosporium herbarum* [ibid., xiv, p. 275]), *Citromyces sanguifluus* Sopp (most likely identical with *Penicillium roseo-purpureum*), and several other species of *P.* and *Verticillium*. Some of these fungi were shown to be powerful acid-formers, e.g., *P. expansum*, which in five days reduced the P_H value of the medium from 5·6 to 3·2, while others, such as *Cylindrocarpon radicicola* and *R. sylvestris*, gradually induce a slight uniform decline in the P_H value; *T. koningi* and *V. glaucum* [ibid., ix, p. 133] caused indiscriminate rises and falls in the hydrogen-ion concentration. *C. radicicola*, *Citromyces sanguifluus*, and *R. sylvestris* reacted to small doses (0·1 per cent.) of calcium carbonate by peculiarities in mycelial growth, accompanied in the case of the last-named by a marked increase in dry weight. *Cylindrocarpon radicicola* and *R. sylvestris* develop best on media with an almost neutral reaction which they gradually shift towards the acid side, and it may be assumed that their behaviour in nature is similar.

Ash seedlings in sterile sand did not thrive and eventually died, while those in non-sterile sand, or in sterilized sand inoculated with fungi or watered with root extract, made considerably better growth. Ash seedlings planted in close contact with *Sambucus nigra* showed a conspicuous retardation of growth, whereas interplanting with *Ranunculus ficaria* somewhat stimulated development, but no exact correlation could be determined between the progress of the seedlings and the composition of the rhizosphere mycoflora.

JOHNSON (EUNICE M.). **Distribution of Cephalosporium and Verticillium on Elm in Massachusetts.**—*Plant Dis. Reptr.*, xxi, 3, pp. 58–59, 1 map, 1937. [Mimeographed.]

Some 75 per cent. of the 5,000 specimens examined at the Shade Tree Laboratory in 1935–6 were collected from elm trees, and the opportunity was taken to compile a statistical survey of the relative prevalence in Massachusetts of the *Cephalosporium* and *Verticillium* wilts [*R.A.M.*, xv, pp. 130, 485; xvi, p. 142]. The former fungus was found to be much the more widespread, occurring in 337 of the samples inspected, while the latter was present in 142.

WALTER (J. M.) & MAY (C.). **Pathogenicity of a brown cultural variant of Ceratostomella ulmi.**—Abs. in *Phytopathology*, xxvii, 2, pp. 142–143, 1937.

Ceratostomella ulmi was shown by a study of monospore (conidium and ascospore) isolations to comprise a wide range of cultural races, some of which retained their distinctive characters through several transfers while others continued sectoring. A brown variant isolated from diseased elms in the United States [*R.A.M.*, xvi, p. 350 and next abstract] and England differs strikingly from the characteristic type. It was inoculated with successful results into American elms in the

greenhouse and English elms growing naturally, and was recovered in all cases from the diseased material.

BANFIELD (W. M.). **Distribution of spores of wilt-inducing fungi throughout the vascular system of the Elm by the sap stream.**—Abs. in *Phytopathology*, xxvii, 2, pp. 121–122, 1937.

Spore suspensions of fungi causing elm wilt, including *Ceratostomella ulmi* [see preceding abstract], were injected into the bases or tops of 4- to 8-in. elms from early spring to late autumn [? in Wisconsin]. The spore suspension was poured into a funnel-shaped pan cemented around the stem and all actively conducting vessels severed below the surface of the liquid. Three hours to three weeks after injection the distribution limits of the spores were determined by identification of the fungi in cultures made from centrifuged sap displaced from various levels in the tree or from the subsequently discoloured wood, a procedure involving the cementing of metal collars round the upper ends of stem sectors, filling the collars with sterile water, and collecting the liquid that dripped from the stem bases. The maximum fungal distribution in the trees after three days in April was 2 in. above and 2 ft. below the points of injection. After three hours in June spores were recovered 30 ft. above the sites of insertion and after two days in October 24 ft. below them. *C. ulmi* spores were removed from the sap stream of naturally diseased trees in May, July, and September.

SLEETH (B.) & ROTH (E. R.). **Basal decay in Oak-stands of sprout origin.**—Abs. in *Phytopathology*, xxvii, 2, pp. 139–140, 1937.

Stereum gausapatum [see next abstract] was found to be the agent of a basal decay of sprouted oaks [*R.A.M.*, xvi, p. 4] in 75 per cent. of the specimens examined in the eastern and central United States, *Quercus velutina* showing the highest and *Q. montana* the lowest incidence of infection. Over 90 per cent. of the decay was traced directly to the parent stump, the remainder originating largely from the removal of a companion sprout or from a dead standing sprout.

DAVIDSON (R. W.), CAMPBELL (W. A.), & BLAISDELL (DOROTHY J.). **Cultural identification as a necessary supplement to tree decay studies.**—Abs. in *Phytopathology*, xxvii, 2, p. 127, 1937.

Among the more important of the relatively little known fungi ascertained to be responsible for extensive decay of trees during the last three years in the United States are *Stereum gausapatum* [see preceding abstract], *Polyporus compactus*, *Poria andersonii*, and *Corticium lividum* from oaks, *Polyporus glomeratus* from maple [*Acer* spp.], and *Stereum murrayi* from birch. The following characters are used in the identification of the organisms from diseased material: growth rate at different temperatures, colour and texture of mycelial mat, fruiting in culture, odour, oxidase reaction, and microscopic appearance. Cultural comparison is essential for the correct determination of these fungi, many of which cause similar types of decay; few of the heart-rotting group produce sporophores, and several different organisms may be present in a single tree.

ŠKORIĆ (V.). **Poria obliqua (Pers.) Bres. Prinos poznavanju biologije i patološkog djelovanja gljive.** [*Poria obliqua* (Pers.) Bres. A contribution to the biology and pathology of the fungus.]—Reprinted from *Ann. Exp. for., Zagreb, 1937*, 31 pp., 4 pl., 5 figs., 3 diags., 1937. [German summary.]

A morphological, cultural, and taxonomic account is given of *Poria obliqua* [*R.A.M.*, xvi, p. 139], which is stated to be fairly frequent in Jugo-Slavia on the bitter oak [*Quercus cerris*], the evergreen oak [*Q. ilex*], and the beech, in association with a white or yellowish heart rot resulting in the formation of cavities of varying size inside the trunks; the rotting wood is separated from the healthy sap wood by a dark brown zone, 5 to 10 mm. thick, and is traversed by transverse and longitudinal dark brown lines. While the pathogenicity of *P. obliqua* was not tested experimentally, observations indicated that the heart rot invariably developed round a dead branch or twig, and was further assisted by the activity of secondary organisms.

COLE (J. R.). **Bunch disease of Pecans.**—Abs. in *Phytopathology*, xxvii, 2, p. 125, 1937.

Bunch disease of pecans (*Hicoria* [*Carya*] *pecan*), characterized by branch and shoot brooming, early spring leafage of affected branches, chlorotic, thin, broad, wavy, and flexible leaves, and in the later stages, dying-back of the branches, was first observed in 1932 in the Red River Valley of Louisiana, and is now known to be present also in Mississippi, Oklahoma, and Texas. The disease was transmitted by grafting affected Schley scions on healthy stocks of the same variety. The Schley and Mahan varieties are very susceptible to bunch, while Stuart is highly resistant.

CUMMINS (J. E.). **'Included sapwood' in Karri (E[ucalyptus] diversicolor).**—*J. Coun. sci. industr. Res. Aust.*, x, 1, pp. 29–32, 1937.

Examination of a number of samples of karri (*E*[*ucalyptus*] *diversicolor*) containing so-called 'included sapwood' (i.e., sapwood included by and in the true wood), showed that this sapwood generally contained dead sap-staining fungi. There was no significant difference between the strength of material containing included sapwood and that of the normal true wood. Normal included sapwood is not regarded as a defect in structural material for use under conditions not conducive to decay, but for certain special purposes, such as wood pipe stock, its presence is undesirable. It appears to be always associated with borer development in the living tree.

KAUFERT (F. H.). **The biology of Pleurotus corticatus Fries.**—*Tech. Bull. Minn. agric. Exp. Sta.* 114, 35 pp., 10 figs., 1 graph, 1936. [Received June, 1937.]

A fully tabulated account is given of the writer's cultural studies on five collections of *Pleurotus corticatus* from fire-scarred trees (three from *Liquidambar styraciflua* and two from *Quercus nuttallii*) in the Mississippi Delta; the affected trees showed decayed areas extending up to 10 or 12 ft. up the centre of the bole. The fungus grew best at 27° C.

on malt agar, forming conidia on coremia and also singly on both the dicaryotic and haploid mycelia. Fertile sporophores were formed in culture on a mixture of barley, wheat, and basswood (*Tilia americana*) sawdust. Mating experiments showed the fungus to be heterothallic and tetrapolar. Basswood sawdust was more rapidly decayed by the dicaryotic than by the haploid mycelia in tests lasting 90 to 150 days, after which time, however, the difference begins to disappear; after 90 days the loss in weight caused by the haploid cultures ranged from 3 to 5 per cent. compared with 9 to 17 per cent. for the dicaryotic. The optimum moisture content for decay is between 110 and 130 per cent., rather higher than that of most wood-rotting fungi, while at 150 to 170 per cent. the rate of decay fell sharply. Coremia and conidia are formed in and on basswood blocks, suggesting that the fungus may be disseminated by termites, ants, or other insects in nature.

LIESE (J.). **Die Douglasienrassen und ihre Anfälligkeit gegenüber der Douglasiennadelschütte (Rhabdocline pseudotsugae).** [Douglas Fir types and their susceptibility to Douglas Fir leaf fall (*Rhabdocline pseudotsugae*).]—*Mitt. dtsch. dendrol. Ges.*, xlviii, (*Jb.*), pp. 259–263, 2 pl., 1 diag., 1936.

Details are given of the reaction to needle fall (*Rhabdocline pseudotsugae* [*R.A.M.*, xvi, p. 289] in two districts of Germany of Douglas firs of the three main groups (mountain, transition, and coast) of American origin, the two first roughly corresponding to the blue and grey (*caesia* and *glauca*) types and the last-named to the green (*viridis*). The reputed immunity of the coastal types from *R. pseudotsugae* has not been maintained under experimental conditions, but the damage suffered by trees of this group is negligible in comparison with the injury caused by the disease to the grey forms (the blue are very seldom encountered in German forests), and stringent efforts should be made by nurserymen and silviculturists to exclude any commerce in seeds of the susceptible varieties.

ROHDE (T.). **Erscheinungsformen und Erkennung der Schweizer Douglasienschütte.** [Manifestation forms and recognition of the Swiss needle cast of Douglas Firs.]—*Silva*, xxv, 9–10, pp. 69–77, 10 figs., 1 graph, 1937.

After briefly summarizing the information hitherto available on the needle cast of Douglas firs [*Pseudotsuga taxifolia*] caused by *Adelopus* [*gäumanni*: *R.A.M.*, xvi, p. 356], the writer gives a full account of his supplementary studies on various phases of the disease in Germany.

Like the needle fall of the same host (*Rhabdocline*) [*pseudotsugae*: see preceding abstract], the *Adelopus* disease falls into several more or less distinct stages, but whereas the former fungus attacks first the youngest and then the older needles, the latter pursues a diametrically opposite course, starting on the oldest material available and gradually proceeding to the current year's shoots. In view of the great importance of this phase of the highly complex *Adelopus* disease from the practical standpoint, the writer attempts to formulate the correlations between the incidence of needle cast and the different years of attack, and in this connexion attention is drawn to a number of varying pathological types

arising from the irregular distribution of needles and bare places on the branches. A common phenomenon in diseased trees is the development from the so-called 'sleeping eyes' (dormant buds) of 'water shoots', due to an access of light to the crown from the gaps in the needles. Most of the 'water shoots' observed were one or two years old, but one was four years old, indicating the occurrence of an epidemic in 1931–2.

A detailed description is given of the gradual modifications in the colour of affected needles, accompanying the disease, none of which, however, radically alters the basic green tint until the brown of incipient necrosis becomes apparent. The diseased material presents a variety of shades of yellow, brown, grey, and white superimposed on the green, while rust-coloured spots are also conspicuous at a certain stage. The underside of the needle remains almost or quite free from discoloration.

Viable perithecia may be found at any time of year on all needles, even on fallen and extensively decayed material, but the percentage of ascospore germination declines with age. Apparently the fungus occupies the needles for several consecutive years and annually forms new fruit bodies which remain viable long after reaching maturity.

Transverse sections through fallen needles reveal a conspicuous, fairly coarse inter- and intracellular mycelium distinct from that of *A. gäumanni*, 4 μ in diameter, and not uncommonly showing branching of the hyphal tips. Hyphae of this type were detected in the current season's needles in the late summer and in much greater profusion in one-year-old needles in May. Pure cultures of needle fragments dating from 1936, 1935, and 1934 yielded, respectively, 15, 22, and 26 per cent. *Adelopus* and 4, 6, and 2 per cent. of the undetermined 'alien' mycelium, while 14, 4, and 5 per cent., respectively, were sterile.

LANGNER (W.). **Der Lärchenkrebs.** [Larch canker.]—*Forstarchiv, 1937*, 3, pp. 38–43, 3 figs., 1937.

This is an abbreviated account mainly concerned with the practical silvicultural aspects of the writer's studies on larch canker in relation to *Dasyscypha willkommii* [*R.A.M.*, xvi, p. 220] and environmental factors, the complete version of which has been noticed from another source [ibid., xv, p. 693].

FINDLAY (W. P. K.). **Dry rot investigations in an experimental house.** —*Dep. sci. indus. Res. For. Prod. Res. Rec.* (*Mycol. Ser.* 1) 14, 14 pp., 5 pl., 5 figs., 1937.

Observations since 1931 in the experimentally constructed house at Princes Risborough [cf. *R.A.M.*, xv, p. 186] showed that in the room made with five types of solid flooring inoculated with *Merulius lacrymans* a certain amount of moisture penetrated even the best mixed concrete. The fungus mainly responsible for the decay of badly constructed solid floors is *Coniophora cerebella* [*C. puteana*]. *M. lacrymans* grew actively for a time after its introduction, but conditions apparently became too moist for it, and *C. puteana* became the chief agent of decay.

A continuous damp course of completely waterproof material (e.g., bitumen) must be provided between the concrete raft and the boards. The type of floor in which the boards are nailed directly to battens embedded in the concrete is thoroughly bad. The boards may be nailed

either to a layer of breeze concrete, or to breeze or impregnated wooden fixing-blocks let into the concrete, covered with a layer of bitumen at least ⅛ in. thick, not less than 10 lb. per sq. yd. being used. The underside of the floor boards should be treated by brush application of a wood preservative if they have not been impregnated.

In the second experimental room, which has a badly constructed, hollow floor inoculated with *M. lacrymans*, fungal growth was determined by weather conditions. Most of the decay during the experiment was due to *M. lacrymans*, which was introduced, but in places rot developed from natural infections of *C. puteana*. *Thuja plicata* boards showed no rot after 33 months, but boards of *Tsuga heterophylla* were attacked in places, mainly by *C. puteana*.

The data obtained demonstrate that if a floor is well constructed and properly ventilated so that the moisture content of the wood remains under 20 per cent., dry rot fungi will not develop even if the most virulent infection is introduced.

GILBERT (W. W.) & POPENOE (C. H.). **Diseases and insects of garden vegetables.**—*Fmrs' Bull. U.S. Dep. Agric.* 1371, 57 pp., 66 figs., 1937.

This is a revision (with the participation of D. J. Caffrey in the place of the late C. H. Popenoe) of an earlier bulletin of the same series and title dealing in popular terms with a number of well-known vegetable diseases and their control in the United States [*R.A.M.*, iii, p. 495].

HAENSELER (C. M.) & MOYER (T. R.). **Effect of calcium cyanamide on the soil microflora with special reference to certain plant parasites.**—*Soil Sci.*, xliii, 2, pp. 133–150, 1 pl., 1937.

Calcium cyanamide (containing 61·5 per cent. $CaCN_2$) applied to sassafras loam soils at the New Jersey Agricultural Experiment Station in amounts up to 10,000 lb. per acre induced striking modifications in the population of fungi, bacteria, and actinomycetes as determined by the plating method. A greater decrease in fungal numbers occurred in soils with reactions near the neutral point than in those of more acid composition.

Both calcium cyanamide and hydrated lime gave effective control of club root of rape (*Plasmodiophora brassicae*) [*R.A.M.*, xvi, p. 222], the former being more active in soils with relatively high P_H values. In pot tests, 200 lb. calcium cyanamide per acre gave fair control of the disease on a soil with an original P_H of 6·4, whereas only a slight reduction in its incidence followed the application of 800 lb. to a soil with an initial reaction of P_H 4·6. In field trials over a three-year period, plots receiving a total of 7,500 lb. lime and 1,800 lb. calcium cyanamide produced very superior crops to those given either of the two treatments singly. In very acid soils the quantity of calcium cyanamide necessary to ensure control proved toxic to the crop immediately following. On heavily infested field plots, liberal treatments with calcium cyanamide and hydrated lime permitted vigorous development of fibrous roots, with the result that even diseased plants were not seriously affected, whereas on adjacent untreated plots, club root was very severe.

Calcium cyanamide, thoroughly incorporated in the soil at rates of

1,000 to 2,000 lb. per acre greatly reduced seed decay and damping-off (*Rhizoctonia* and *Pythium*) [ibid., xiii, p. 497] of cucumber planted immediately after treatment. Used at the rate of 5 to 50 lb. per acre of 24 in. rows and applied in close proximity to the seed just before planting also gave satisfactory control of the damping-off fungi, but under these conditions there was a very narrow margin of safety in respect of seed injury.

A substantial reduction in the incidence of pea root rot (*Aphanomyces euteiches*) [ibid., xii, pp. 413, 609; xvi, p. 234] was effected by the application of calcium cyanamide to outside soil frames at rates of 1,000 to 1,500 lb. per acre, but no beneficial action was exerted by the compound at 1,000 and 2,000 lb. per acre in field trials, nor was it of any value against beet scab (*Actinomyces scabies*).

Coons (G. H.), Kotila (J. E.), & Stewart (D.). **Savoy, a virus disease of Beet transmitted by Piesma cinerea.**—Abs. in *Phytopathology*, xxvii, 2, p. 125, 1937.

Sugar and garden beets in Michigan, Ohio, Minnesota, Nebraska, South Dakota, Colorado, and Wyoming have been observed to show up to 5 per cent. infection by a disease involving stunting, downward curling, and 'savoying' of the leaves, especially the innermost, veinlet clearing followed by thickening, giving a netted aspect to the dorsal leaf surface, and in the final stages discoloration and phloem necrosis of the roots, simulating curly top [*R.A.M.*, xvi, p. 387], from which, however, as well as from the German crinkle [ibid., xv, p. 549], the present disorder is quite distinct. 'Savoy' has been transmitted by adults of *Piesma cinerea* (both viruliferous and non-viruliferous individuals of which are found), but not by means of juice, nor by *Eutettix tenellus*. The virus overwinters in diseased plants and in the insect vector; its incubation period in the sugar beet ranges from three to four weeks. Possibly the disturbance reported from Indiana by Arthur and Golden (1892) and the 'leaf curl' noted in Michigan in 1901 may represent early records of the trouble under observation, the economic significance of which is not expected to be great.

Larmer (F. G.). **Keeping quality of Sugar Beets as influenced by growth and nutritional factors.**—*J. agric. Res.*, liv, 3, pp. 185–198, 1 fig., 1937.

The experiments reported in this paper were carried out in 1932 and 1933 at two centres in Utah, following observations indicating that immature beetroots grown in nutrient cultures deficient in phosphorus were rendered extremely susceptible to invasion by *Phoma betae* which, in association with certain other organisms, is responsible for the decay of the sugar beets in storage [*R.A.M.*, xv, p. 764]. The importance of the loss in sucrose due to such decay is well illustrated by the fact that a large sugar-manufacturing company in the west of the United States estimates the shrinkage in yield in a single season at a value of over $5,000,000, basing itself on the difference of the sucrose percentages established before the storing of the beets and at the moment when they were actually sliced at the factories. While admittedly a portion of this

reduction in sucrose is due to the respiration of the beets in storage, a large part of it is caused by the activity of the rotting organisms.

The fields selected for the tests were known to be deficient in available phosphates, and were divided into three plots, one of which was supplied with a phosphate fertilizer, the second received a complete fertilizer, and the third was left untreated as control. The tabulated results of 75 days' storage experiments in 1933 (in which root decay was most pronounced) showed that while 17·48 per cent. by weight, of the root tissues of beets from the untreated plot was destroyed by the rot organisms, the beets from the phosphate and the complete fertilizer plots showed only 4·23 and 6·18 per cent. decay, respectively. There was also an indication that the phosphate fertilizer reduced the loss in sucrose reserves due to respiration. A further series of tests showed that adequate moisture during the growing season improved the keeping quality of the crop, as well as applications of farmyard manure, presumably chiefly because of its content of available phosphate, its indirect action in making soil phosphate available, and its effect on soil moisture.

These findings were fully corroborated by the results of experiments, which showed that, when artificially inoculated with *P. betae*, roots grown in the presence of an adequate supply of phosphorus developed significantly less decay than the roots from the unfertilized plots.

BURGEVIN [H.] & FOËX (E.). **La maladie du coeur de la Betterave en France.** [Beetroot heart rot in France.]—*C.R. Acad. Agric. Fr.*, xxiii, 6, pp. 195–197, 1937.

In consequence of the damp summer of 1936, heart rot of beets in France did not generally assume such a serious character as in the two preceding years [*R.A.M.*, xiv, p. 282]; the disease was adequately combated where necessary by the application of boric acid to the soil at the rate of 6 to 8 (Loir-et-Cher) or 10 (Mayenne) kg. per hect.

G. Bertrand followed up these observations (pp. 197–199) by some remarks on the constant association of a fungal pathogen [? *Phoma betae*] with beets suffering from heart rot, denoting a connexion between an adequate supply of nutrients (boron in this particular case) and ability to withstand disease.

MEYER-HERMANN (K.). **Bor—das Heilmittel der Herz- und Trockenfäule der Rübe.** [Boron—the cure for heart and dry rot of the Beet.]—*Dtsch. landw. Pr.*, lxiv, 7, p. 75, 1937.

The writer recapitulates his recommendations, based on extensive and protracted field experiments in Germany, for the control of heart and dry rot of beet by the application to the soil of 3½ to 5 kg. borax powder per ¼ hect. [*R.A.M.*, xv, p. 189; xvi, p. 149], which has frequently resulted in increased yields of 1,250 to 3,500 kg. per ¼ hect. (equivalent to a profit of over M. 100 for an outlay of only M. 1·20 to 1·50). The new mixed boron-superphosphate fertilizer obviates the need for the admixture of 15 to 25 kg. potash salt, sand, or superphosphate with the borax powder (3½ to 5 kg.), and should be applied at the rate of 75 to 100 kg. per ¼ hect.

CHAMBERLAIN (E. E.). **Pea mosaic. Its symptoms, economic significance, and preventive treatment.**—*N.Z. J. Agric.*, liv, 3, pp. 129–138, 9 figs., 1937.

Apart from information already noted from another source [*R.A.M.*, xvi, p. 294] the following items may be mentioned from this paper. A test carried out in New Zealand in 1935–6 showed that garden peas with a small percentage of mosaic suffered a reduction of yield, as compared with the healthy controls, of 47·7 per cent. The disease is thought to overwinter on red clover [*Trifolium pratense*] and is spread to other susceptible hosts by aphids in the spring and summer. Field and glasshouse experiments indicated that the Lord Chancellor and Little Marvel varieties are immune from or highly resistant to the disease; for purposes of control the use of these varieties and the growing of other susceptible crops as far removed as possible from areas of infected red clover are recommended.

BRETT (C. C.), DILLON WESTON (W. A. R.), & BOOER (J. R.). **Seed disinfection. III. Experiments on the germination of Peas. Seed protection by the use of disinfectant dusts containing mercury.**—*J. agric. Sci.*, xxvii, 1, pp. 53–66, 1 pl., 1937.

A fully tabulated account is given of field and greenhouse experiments, in which various lots of pea seeds were disinfected with seven different organic mercury dusts (three containing each 1, 2, and 3 per cent. mercury as methyl mercury chloride plus 0·5, 1, and 1·5 per cent. mercury as mercuric iodide, respectively; three containing each 1, 2, and 3 per cent. mercury as methyl mercury phosphate; and one containing 1·7 per cent. mercury as phenol mercury acetate). The results obtained are interpreted as indicating that seed disinfection with a suitable dust may give increased stands and higher yields in marketable pods when the peas are sown earlier than in March, owing to its controlling effect on the soil-inhabiting and seed-borne organisms (chiefly *Fusarium* spp. and *Ascochyta pisi*) [*R.A.M.*, xvi, p. 438]; it is, however, of doubtful value for later sowings, since the ratio of pea seed germination in the field to germination in the laboratory tends to increase as the date of sowing advances, reaching 60 to 65 per cent. for sowings in March and April.

CASALE (L.). **Nuovi rimedi contro la Peronospora della Vite.** [New remedies against Vine *Peronospora*.]—*Ric. sci. Progr. tec. Econ. naz.*, Ser. II, ii, 11–12, pp. 604–609, 1936.

As a result of laboratory and field experiments, the author recommends the following mixture in the control of vine *Peronospora* [*Plasmopara viticola*]: 200 gm. copper sulphate, 50 gm. citric acid, 5 c.c. of a concentrated solution of ferric chloride per 100 l. water, with sufficient sodium hydrate to induce a neutral reaction. The mixture is stated to be comparable in efficacy with Bordeaux mixture but requiring only $\frac{1}{10}$th the amount of copper. [An account of Casale's work is also given by J. Baudin in *Progr. agric. vitic.*, cvii, 21, pp. 494–495, 1937.]

SCHAD (C.). **Les stations d'avertissements agricoles et la lutte contre le mildiou de la Vigne.** [Agricultural forecasting stations and the control of Vine mildew.]—*Ann. Épiphyt.*, N.S., ii, 3, pp. 283–331, 8 graphs, 3 maps, 1936.

In this account of vine mildew (*Plasmopara viticola*) and the development of measures for its control in France, the author discusses in detail the spray warning systems in operation and the factors on which they are based.

In all of the three chief stations, at Montpellier, Bordeaux, and Clermont-Ferrand, the methods used are fundamentally identical. Branas's method [*R.A.M.*, xiv, p. 420], used at Montpellier, is based on the stage of growth reached by the vine and the stage of development reached by the fungus. The primary invasion is determined by observation of the germination of the oospores, and the incubation period is constant, being 9 days for the primary and 7 days for secondary infection. The forecasting of invasions during the summer is made according to the number and state of the infection spots, humidity, duration of rain, and temperature before, during, and after rain.

According to the method devised by Cazeaux-Cazalet and Capus [ibid., x, p. 581], used at Bordeaux, the earliness and intensity of infection is determined by the rainfall from November to April, the secondary invasions being dependent upon the prevalence of spores and the amount of rain. Forecasting is rendered difficult by the variable incubation period in south-western France. When a rainy period is suspected and the vines have 3 or 5 new unsprayed leaves, treatment should be applied. This method enables the date and intensity of an outbreak to be foretold long in advance.

The method used at Clermont-Ferrand is a combination of these two. The dates on which treatment is to be applied are determined by the critical periods of vine growth and the stage of development reached by the fungus when a rainy period is expected.

Müller's incubation calendar method [ibid., xiii, p. 678] requires great care on the part of the grower, who is not generally in a position to make the necessary observations. Moreover, the incubation curve does not strictly apply under French conditions and can only be used in conjunction with other methods, especially where the incubation period varies. The oil spot method used in the Italian province of Treviso [ibid., xvi, p. 86] is regarded as unreliable.

Details are given of the spray warnings issued from the three stations in 1935.

ZWEIGELT (F.). **Das Peronosporajahr 1936 und die französischen Direktträger.** [The *Peronospora* year 1936 and the French non-grafted hybrids.]—Reprinted from *Weinland*, *1936*, 11, 2 pp., 1936.

Details are given of the reaction to the *Peronospora* [*Plasmopara viticola*] epidemic of 1936 at Klosterneuburg, Austria, of a number of French non-grafted vine hybrids. On the whole, the results were very disappointing, the majority of the selections, even those heretofore regarded as resistant, succumbing to the disease, while most of those remaining healthy are undesirable on other grounds. An exception was

constituted by three Kühlmann selections (Bon noir, Fin noir, and Directeur Grosjean).

Small (T.). **Report of the Mycologist.**—*Rapp. aux États de Jersey, 1936*, pp. 30–50, 1937.

The following items, *inter alia*, are included in this report [*R.A.M.*, xv, p. 555, and below, p. 555]. In 1936 potato blight (*P[hytophthora] infestans*) did not become serious or widely prevalent in Jersey until after 26th June, when a large crop of tubers had formed, and cutting or scorching the haulms would have prevented heavy loss. Many growers, however, failed to take this precaution. Scorching of unsprayed crops in an advanced stage of infection reduced the amount of blight but did not prevent considerable loss. Spraing [ibid., xvi, p. 399] and dry rot (*Fusarium coeruleum*) [ibid., xvi, p. 272] were found affecting imported seed potatoes.

Outdoor tomatoes were seriously affected by stem rot (*Didymella lycopersici*) [ibid., xv, p. 690]. Inoculations of wounded and unwounded tomatoes with a spore suspension of the fungus from a diseased tomato gave positive results, while seed from diseased fruit gave *D. lycopersici* in pure culture. Sterilization of such seed in mercuric chloride 1 in 3,000 for 5 minutes, followed by washing in water, killed the fungus in many instances, and did not reduce germination. Inoculation tests demonstrated that all the aerial parts of tomato plants are susceptible even when unwounded. Inoculations of stems at soil-level almost invariably failed to produce infection, and attack at this region was frequently found to be due to the fungus growing back into the stem from the lower leaves. Suggestions for control include the use of seed from healthy fruit only, sterilization of the propagating soil, disinfection of old canes in 2 or 5 per cent. formaldehyde for 20 minutes, followed by covering for two days, removal of infected leaves before the main stem becomes infected, single planting in fields usually severely attacked, and paring off young infections of the stem, the wounds afterwards being painted with Bordeaux paste.

Beaumont (A.) & Staniland (L. N.). **Thirteenth Annual Report of the Department of Plant Pathology, Seale-Hayne Agricultural College, Newton Abbot, Devon, for the year ending September 30th, 1936.**—35 pp., 1937.

In this report, which is on the same lines as those for previous years [cf. *R.A.M.*, xv, p. 555], it is stated that in forecasting outbreaks of potato blight [*Phytophthora infestans*] results as good as those given by the five rules previously used were obtained by using two only, viz., (1) minimum temperature 50° F. or over, (2) relative humidity not under 75 per cent. for at least two days. This simplification is to be adopted for future use.

Of the chief commercial tulip varieties grown in south-western England Bartigon, William Copeland, and William Pitt are very susceptible to fire [ibid., xv, p. 508], Avis Kennicott, Carrara, Farncombe Sanders, Princess Elizabeth, Sieraad van Flora, and Zwanenburg fairly susceptible, Clara Butt, Inglescombe Yellow, Moonlight, and Mrs. Moon slightly so, and Baronne de la Tocnaye fairly resistant.

These varieties all belong to the Darwin and Cottage groups. The Mrs. Kerrell and Sultan varieties are fairly resistant.

In notes on fungal diseases observed during the year it is stated that red core (*Phytophthora* sp.) [allied to *P. cinnamomi*: ibid., xv, p. 450] did severe damage to Western Queen and Madame Lefebre strawberries on two farms in the Tamar valley; the identification was confirmed by Mrs. Alcock. Narcissus fire (*Botrytis polyblastis*) [ibid., xiv, pp. 366, 637] occurred in Scilly in April and was exceptionally severe in Cornwall in May. The Pinkie and Sierra Snow snapdragon [*Antirrhinum majus*] varieties at Seale-Hayne showed only 25 and 6 per cent. rust [*Puccinia antirrhini*: ibid., xvi, p. 387], respectively, as against 70 and 90 per cent., respectively, for Melrose and Orange King; Glowing Sunset was unaffected. Marigold smut (*Entyloma calendulae*) [ibid., xvi, p. 493] was prevalent near Penzance. Lupins were affected by leaf spot (*Ceratophorum setosum*) [ibid., xv, p. 775] and mallows (*Lavatera trimestris*) suffered severely from the attacks of *Colletotrichum malvarum* [ibid., vi, p. 462]. *Solanum crispum* was attacked by potato blight [*P. infestans*], a new record for the fungus, *Peronospora grisea* was found on *Veronica* in Scilly, and *Pyracantha* scab (*Fusicladium* [*pirinum* var.] *pyracanthae*) [ibid., xv, p. 230] was noted at Braunton.

GALLOWAY (L. D.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst., New Delhi, 1935–36*, pp. 105–111, 1937.

After referring to the removal of the Imperial Agricultural Research Institute from Pusa to New Delhi the author records the following items of interest, *inter alia*, in this report [cf. *R.A.M.*, xvi, p. 231]. Morphological studies and cross-inoculation experiments indicated that the species of *Colletotrichum* causing a leaf disease of maize in the former locality was identical with *C. graminicola* [ibid., xv, p. 795] which occurs on sorghum. *C. curvatum*, recently reported for the first time in India [ibid., xv, p. 703] on sunn-hemp [*Crotalaria juncea*], is extremely virulent, a spore suspension sprayed on young seedlings producing 100 per cent. mortality; seed treatment gave some control, and considerable protection against infection was afforded by spraying, though this did not arrest the disease.

Asparagus was affected by *Phoma asparagi*, a new record for India [ibid., xvi, p. 13]. The grape rot previously reported as due to a *Coniella* [ibid., xvi, p. 232] was apparently caused by *C. diplodiella* (Speg.) Petr. & Syd. Hemp seedlings were attacked by *Pythium aphanidermatum*. A smut due to *Urocystis sorosporioides* Koernicke was found on *Delphinium* from Simla. *Corticium rolfsii* was stimulated to form its perfect stage by culture in onion-peptone broth.

In the second part of this report (pp. 112–122, by B. L. Chona) it is stated that the thermal death point of Saretha sugar-cane mosaic virus was found to be a little over 50° C., but heating to this temperature did not appreciably reduce the infective power of M. 16 and Co. 313 sugar-cane mosaic virus; further heating at 60° inactivated the latter, but did not completely inactivate the former. The thermal death point of Co. 213 and Red Mauritius mosaic viruses was found to lie between 40° and 45° and 40° and 50°, respectively. Clear brown L 3 filtrate of mosaic juice was non-infective. With both Co. 213 and Saretha mosaic

leaf juice the infective power appeared to fall rapidly when the juices were diluted to 1 in 10 or more. Maize and sorghum inoculated with Co. 213 mosaic juice readily developed infection, with marked mosaic symptoms.

SHEPHERD (E. F. S.). **Botanical and Mycological Division.**—*Rep. Dep. Agric. Mauritius, 1935*, pp. 23–26, 1936.

The following items, *inter alia*, occur in this report [cf. *R.A.M.*, xv, p. 203]. From January until April, 1935, the BH 10/12 sugar-cane variety was somewhat severely affected by smut (*Ustilago scitaminea*) [ibid., xv, p. 607; xvi, p. 232] on several low-lying estates in Mauritius, the high temperatures experienced early in the year possibly having favoured infection. Some crop loss was experienced, especially in the third and fourth ratoons. In November, a moderately heavy outbreak of eye spot disease (*Helminthosporium ocellum*) [ibid., xv, p. 781] occurred in fields of 11 months-old, virgin BH 10/12 cane on one estate.

Tobacco mosaic [ibid., xvi, p. 412] was again present on two estates in the Black River district, but a more systematic roguing late in the year resulted in spread being checked. Inoculation tests demonstrated that mosaic of *Solanum nigrum*, a common weed locally, is transmissible to tobacco. The author considers that the severe mottling seen on the new tobacco disease associated with leafy outgrowths observed in September, 1935 [ibid., xv, p. 610], may possibly indicate that the condition is a combination of mosaic and Storey's leaf curl, but the identity of the disease has not yet been determined. Black shank (*Phytophthora parasitica*) [*nicotianae*: ibid., xvi, pp. 412, 413] caused losses on many estates; some strains of Amarello are showing more resistance than the original one. Granville wilt (*Bacterium solanacearum*) [loc. cit.] was noted in many localities.

Needle inoculations with bacteria isolated from a heart rot of the white palm *Dictyosperma album* gave positive results on young plants of the same host and on maize.

Report of the Waite Research Institute, Glen Osmond, South Australia, 1933–1936.—182 pp., 27 figs., 15 graphs, 1937.

In the section of this report dealing with manganese deficiency it is stated that the output of mixed fertilizer (sold in bags containing 28 lb. of manganese sulphate—now marketed at £[Australian]15. 10. per ton—and 159 lb. of superphosphate) reached 481 tons in South Australia in 1936, or enough for 8,000 to 10,000 acres. From 1931 to 1935 the yield of barley at Corny Point in fields to which no manganese sulphate was applied averaged 16 bush. 21 lb. per acre, as against 23 bush. 49 lb., 26 bush. 45 lb., and 27 bush. 44 lb. for dressings of 14, 28, and 42 lb. of manganese sulphate per acre, respectively [*R.A.M.*, xi, p. 568].

The apricot gummosis recently reported [ibid., xiv, p. 559] occurs in all apricot sections of South Australia. The disease generally develops in association with a recent pruning cut; sometimes the tip of the leader dies back for a short distance, but if the disease starts in the lower part of a limb, gum exudes, and the bark dies and may split longitudinally near the junction of healthy and diseased tissue. Infection spreads more rapidly up and down than laterally, and nearly the entire

cross-section of a branch in time becomes diseased. When infection has progressed considerably along the branch the leaves wilt, but do not fall, and excision of the affected branch is no longer able to save the tree. Inoculations of wounded apricot branches of all ages with pure cultures of a fungus readily isolated from diseased material gave positive results. The fungus forms pycnidia with spores conforming to *Cytosporina*, but it is possible that other spores may also prove to be present.

In reviewing the investigations on tobacco mosaic and tomato spotted wilt [already noticed from other sources] it is stated that while no variety has been found resistant to the latter disease, *Lycopersicum pimpinellifolium* proved highly resistant in the field, but attempts at breeding from this species are so far unsuccessful. Other possibilities of control are briefly discussed.

Forty-sixth Annual Report for the fiscal year ended June 30, 1936.—*Bull. Wash. St. agric. Exp. Sta.* 342, 75 pp., 1936. [Received April, 1937.]

The following are among the references of phytopathological interest in this report [cf. *R.A.M.*, xv, p. 344]. Of 104 spring wheat varieties inoculated by E. F. Gaines and his collaborators with a mixture of 20 bunt [*Tilletia caries* and *T. foetens*] types [ibid., xvi, pp. 27, 28, 90, 165], four remained free from the disease, as well as a few durums and emmers. One of the 20 physiologic races attacked five out of ten resistant wheat strains, while six failed to infect any of the latter; the others were more or less virulent. Several Australian wheats remained healthy following inoculation with a mixture of all known bunt races. Seedlings of 26 wheat varieties inoculated with a composite of three bunt races generally sustained heavier damage from controlled freezing temperatures than plants from healthy seed.

The covered smut of slender wheat grass [*Agropyron tenerum*] was found by G. W. Fischer and collaborators to be due to *Ustilago bullata* [ibid., vi, p. 293] (the first record for the United States), and not to *U. bromivora* as reported from Canada [ibid., xv, p. 445]. Cross-inoculations between the smut on *A. tenerum* and that on brome grasses [*Bromus* spp.] gave negative results.

L. K. Jones and C. L. Vincent found that some degree of resistance to the veinbanding virus was shown by the Katahdin potato variety [ibid., xv, p. 460; xvi, p. 487] in the field, though it proved very susceptible to mechanical juice inoculation. This variety, moreover, was the only one out of ten to confer resistance on the progeny in hybridization tests, and therefore constitutes the most promising material for breeding work. Field infection by the veinbanding virus was very severe on the Gold Coin, Bliss Triumph, Irish Cobbler, and Warba varieties, less so on Russet Burbank.

The host range of enation mosaic of peas [see below, p. 583] was ascertained by L. K. Jones and F. Johnson to be much narrower than that of severe mosaic. Market-garden and canning peas in the western part of the State sustain the greatest damage from these disorders.

In C. D. Schwarze's and G. A. Huber's experiments a certain proportion of the offspring of crosses between resistant and susceptible

parents showed a high degree of resistance to raspberry mosaic [ibid., xvi, p. 194], amounting in some cases to immunity in the field.

F. D. Heald and H. English have been engaged on a study of the rots affecting pears (chiefly Bartlett, d'Anjou, and Winter Nelis) in certain districts producing comparatively small crops. Storage decay appears to be due mainly to the blue (*Penicillium* spp.) [ibid., viii, p. 49] and grey (*Botrytis* spp.) moulds [ibid., xiii, p. 246; cf. also xv, p. 701], though species of *Alternaria*, *Cladosporium*, *Dematium*, *Fusarium*, *Gloeosporium*, *Helminthosporium*, *Hendersonia*, *Mucor*, *Phoma*, *Phytophthora*, *Pleospora*, *Rhizopus*, *Sporotrichum*, *Stemphylium*, and a number of unidentified sterile fungi were also occasionally isolated. The lenticels were shown by inoculation experiments to be the usual channels of invasion.

No mosaic mottle was observed by F. D. Heald and R. Wellman on the foliage of apple trees producing bitter pit [ibid., xvi, p. 325] fruits during the previous season, or on that of any other apple trees in the Wenatchee district, though forms of the disease were detected on cherry [ibid., xv, p. 664], plum [ibid., xvi, p. 330], apricot [ibid., xiv, p. 368], and a number of shade trees.

Black root of strawberries [ibid., xv, p. 780] was found by F. D. Heald and collaborators at the Western Washington Experiment Station to be very prevalent as a consequence of severe winter conditions inducing freezing.

The following diseases, either new to the State or occurring with exceptional severity, were among those observed in the course of a phytopathological survey by the same workers: pea rust (*Uromyces fabae*) [ibid., xiii, p. 670] and leaf spot of lilac (*Phyllosticta syringae*) [ibid., vi, p. 754]—new records, cucumber mosaic [ibid., xv, pp. 385, 489, *et passim*], mosaics of red clover [*Trifolium pratense*: ibid., xvi, p. 84], lucerne [ibid., xv, p. 274], peach [see below, p. 543], *Catalpa*, poplar [ibid., xiv, p. 462], cabbage [ibid., xv, p. 444], and lupin [ibid., xiii, p. 317], witches' broom of lucerne [ibid., xv, p. 724], and 'pink cherry'.

A new disease of Cacao on the Gold Coast.—*Trop. Agriculture, Trin.*, xiv, 3, p. 84, 1 fig., 1937.

In this article, reprinted from *The Gold Coast Farmer*, v, 7 and 8, December, 1936, a new disease of cacao, termed 'swollen shoot and die-back', is reported from the Gold Coast, where it is said to be widely distributed in the New Juaben district of the Eastern Province. The young growing shoots (chupons) develop abnormal swellings, which may be over an inch thick, separated by constrictions one to several inches in length and sometimes less than ¼ in. thick. This symptom is followed by defoliation and die-back affecting all parts of the tree simultaneously; the young, deformed shoots dry up and wither, the growth of the pods becomes arrested, and the whole tree dies. The roots remain normal, except for occasional swellings resembling those found on the shoots. The disease occurs in patches up to 30 yds. in diameter, and trees in the early stage of the disease have been observed on the borders of the patches, so that there is some evidence of radial spread from a central point, though the cause of the trouble has not yet been ascertained.

It is proposed to cut out and burn all the diseased trees, together with a few apparently healthy ones at the circumference of each diseased area, compensation being paid to growers for the destruction of healthy trees, and also to plant windbreaks to protect the remaining trees from exposure.

Lowig (E.). **Der Einfluss des Kieselsäuregehaltes auf den Mehltaubefall der Gramineen.** [The influence of the silicic acid content on mildew infection in the Gramineae.]—*Pflanzenbau*, xiii, 9, pp. 362–367, 1937.

The results of the writer's observations and experiments, initiated in 1930 under the leadership of [T.] Remy at the Bonn-Poppelsdorf Agricultural College, on the relation of the silicic acid content of wheat, oats, barley, and meadow grasses to mildew (*Erysiphe graminis*) are briefly summarized. Most of the data here presented have been noticed from other sources [*R.A.M.*, xiv, p. 571]. A minimum content of silicic acid of 1 per cent. of the dry weight was found to be necessary for the protection of the cereals against the disease, an amount considerably exceeding that commonly assimilated by these plants on poor sandy soils.

Die Verwendung von gebeiztem Saatgut 1935–36. [The use of disinfected seed-grain in 1935–6.]—*NachrBl. dtsch. PflSchDienst*, xvii, 3, pp. 24–25, 1937.

According to an article in *Wirtschaft u. Statistik* (January, 1937) [detailed tabulated data from which are given], an average of 55·7 per cent. of the total quantity of cereal seed-grain sown in the German Reich during 1935–6 was subjected to disinfection, 20 per cent. being treated by the liquid and 35·7 per cent. by the dry process. Winter wheat received more attention in this respect than any of the other cereals, only 9·9 per cent. of the total acreage being left untreated, followed by summer wheat, four-fifths of the total acreage of which was disinfected, whereas over two-thirds of the oat crop was sown without treatment; the proportion of treated seed-grain for the other cereals ranged from 38 to 75 per cent. It is estimated that some 940,000 tons of seed-grain were disinfected with chemical preparations during the period under review.

Korhammer (K.). **Entwicklung der Lohnbeizung in Westfalen.** [The development of co-operative disinfection in Westphalia.]—*Nachr. SchädlBekämpf., Leverkusen*, xii, 1, pp. 1–13, 7 figs., 1 map, 1937. [English, French, and Spanish summaries on pp. 41, 44–45, 48–49.]

Particulars are given of the great advance in the system of co-operative seed-grain disinfection [*R.A.M.*, xvi, pp. 444] in Westphalia [ibid., xii, p. 559], where the plants officially licensed [ibid., xiv, p. 736] for this treatment numbered 453 on 1st December, 1936, as compared with 63 on 1st April, 1928. From an inspection of treated material in 1936 it appeared that the disinfection process (mostly dusting with ceresan) had been correctly applied in 59·4 per cent. of the samples, whereas before the inauguration of official supervision errors either of excess or deficiency occurred in over 80 per cent. Thirty per cent. of

the installations in 1936 were in the hands of co-operative societies, the corresponding figures for mills and for grain merchants and the like being 33 and 37 per cent., respectively. Most of the seed-treating appliances referred to in this paper have already been mentioned in this *Review* from other sources; in addition to the dusting apparatus there are 76 continuously working short disinfection process machines in use.

SIBILIA (C.). **L'influenza della altitudine sulla presunta resistenza dei Grani alle ruggine.** [The influence of altitude on the presumed resistance of Wheat to rusts.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvi, 4, pp. 271–277, 1937.

In view of the probability that wheat cultivation will shortly be undertaken by the Italians on the Abyssinian highlands the author reviews and discusses recent work in Kenya on the wheat rusts *Puccinia glumarum*, *P. triticina*, and *P. graminis* [*R.A.M.*, xv, p. 558; xvi, p. 87], and refers to similar work in India [ibid., xvi, p. 445] and Peru [ibid., ix, p. 234]. He considers that studies along the same lines should be begun in Abyssinia as soon as possible.

MACINDOE (S. L.). **The new era in breeding Wheats resistant to stem rust.**—*J. Aust. Inst. agric. Sci.*, iii, 1, pp. 25–31, 1937.

In this survey of the progress made in breeding wheats resistant to stem rust [*Puccinia graminis*] the author states that under Australian conditions the Kenya wheats have shown remarkable resistance, Kenya C. 6040 and its hybrids being practically immune and at the same time satisfactory in point of general agronomic characters, yield, and freedom from drought susceptibility and straw weakness. The resistance of the Kenya wheats has also been more easily recovered in back and multiple crosses than has that of any other parents. Of the advanced generation hybrids now available the most promising lines are from a Kenya × Florence × Dundee cross which is being submitted to field tests. Subsequent crosses of these with Pusa 4 and related lines promise to combine high baking quality with resistance, straw strength, and good yield.

NEWTON (MARGARET) & JOHNSON (T.). **Production of uredia and telia of Puccinia graminis on Berberis vulgaris.**—*Nature, Lond.*, cxxxix, 3523, pp. 800–801, 1 fig., 1937.

In the course of greenhouse inoculation studies with physiological races of *Puccinia graminis tricici* on the barberry made at Winnipeg in 1937, an F_3 culture of a cross between races 36 and 9, and identified as race 36, produced pustules with relatively few pycnidia and scant pycnidial nectar, and failed to produce aecidia in spite of all the attempts to induce their formation; 44 days after inoculation small uredosori were observed on the upper surface of the pustules on the barberry leaves, and further examination showed that of a total of 129 pustules, 50 contained uredosori and 21 of these contained teleutosori, mostly on the upper surface. In another series of tests, sporidia produced in the greenhouse in 1936 from a 1936 collection of race 21 of *P. graminis*, when inoculated on the barberry, gave rise to two types

of pustules, the first normal in every respect, while the pustules of the second were almost white, with no pycnidia or only rudimentary ones that rarely formed pycnidiospores; on five of these pustules uredosori were found, two of which also contained teleutospores.

While the failure of *P. graminis* pustules on the barberry to produce aecidia after intermixing of the nectar is not a new phenomenon, the production of uredo- and teleutospores on the barberry in association with this condition had not been observed hitherto. Both the uredospores and teleutospores on barberry are normal in appearance and the former are able to infect wheat but not barberry, so that the strains are still heteroecious.

BEVER (W. M.). **Influence of stripe rust on growth, water economy, and yield of Wheat and Barley.**—*J. agric. Res.*, liv, 5, pp. 375–385, 3 figs., 1937.

As a result of greenhouse experiments during 1933 to 1935 at Moscow, Idaho, conducted on lines similar to those of Johnston and Miller [*R.A.M.*, xiv, p. 432] with leaf [brown] rust of wheat (*Puccinia triticina*), the author established that infection with stripe [yellow] rust (*P. glumarum*) in the early stages of growth of the susceptible spring wheat Chogat (C.I. 6244) and spring barley Pannier (C.I. 1330) greatly reduced and retarded the development of the plants, and also reduced the production of roots, the yield in grain and straw, the height of the plants, the size and number of heads, and the size and number of grains. For infection at the one-leaf seedling stage the weight of the roots of the two hosts was reduced by 87·6 and 75·9 per cent., that of the total dry matter by 55·7 and 48·7, and the yield of grain by 65·1 and 64·5 per cent., respectively. The quantity of water used per unit of weight was greatly increased. The depressing effect of the rust was much less when infection was delayed, but even with infection as late as at the anthesis stage the reduction in weight of roots and grain was material, the amount of injury being apparently related primarily to the earliness of the stage of development of the hosts at the time of inoculation, rather than to the amount of rust that developed, since this was much the same for all the inoculation groups. Apart from reducing the size and number of the ears and of the grains, the rust also had a shrivelling effect on the latter. Yellow rust had a similar, though less marked, effect on the resistant wheat Garnet (C.I. 8181) and barley Khanaka (C.I. 743), even when very few pustules appeared on the plants; the weight of the roots of wheat was reduced by 24·5, that of dry matter by 18·2, and that of the grain by 31 per cent. In the barley the reductions were somewhat smaller. These results are strikingly similar to those of Johnston and Miller for *P. triticina* [loc. cit.], but this species produces no shrivelling of the grains, merely reducing their size.

STEFANOVSKI (I. A.). Устойчивость Пшениц к бурой ржавчине в условиях Заволжья. [Resistance of Wheat to brown rust under Trans-Volga conditions.]—*Bull. appl. Bot. Select.*, *1937*, Ser. A, 21, pp. 43–52, 1937.

This is a detailed report of the author's investigations in the Lower

Volga basin of the influence of environmental conditions on the development of brown rust (*Puccinia triticina*) on a large collection of wheat varieties and species, a full summary of which has been noticed from another source [*R.A.M.*, xv, p. 708].

KARGAPOLOVA (Mme N. N.). Химические особенности различных видов Пшеницы в связи с их устойчивостью к **Puccinia triticina Eriks.** [Chemical peculiarities of different species of Wheat in relation to their resistance to *Puccinia triticina* Eriks.]—*Bull. appl. Bot. Select.*, *1937*, Ser. II, 11, pp. 179–199, 1937. [English summary.]

This is a full report of the author's investigation of the resistance of certain species and varieties of wheat to brown rust (*Puccinia triticina*), a summary of which has been noticed from another source [*R.A.M.*, xvi, p. 26]. In addition to the information already imparted, it is stated that biochemical studies indicated that of the polyphenols contained in wheat plants, pyrocatechuic phenols are chemically the most active; under the action of autoxidation and of oxidizing enzymes they form persistent tannins, the increasing accumulation of which is believed probably to be one of the most important factors in the resistance of certain plants to fungal diseases. Tests carried out with Dubosque's colorimeter showed a considerably higher content in phenolic compounds in wheat varieties immune from or resistant to brown rust than in the susceptible (the difference between the standard and the tested solutions being 32 to 39 colorimetric units for the former, as against 0 to 10 units for the latter). It was further shown that the individual pure phenols vary widely in their toxic properties to the *P. triticina* spores, the most toxic being hydroquinone and pyrocatechin, and that the acetic-ethyl fraction of the resistant wheat forms is highly toxic as compared to that of the susceptible forms.

ROUSSAKOFF (L. F.). Канред × Фулькастер **266287** и другие американские сорта Пшеницы, устойчивые к бурой ржавчине. [Kanred × Fulcaster 266287 and other American Wheat varieties resistant to brown rust.]—*Bull. appl. Bot. Select.*, *1937*, Ser. A, 21, pp. 31–42, 1937.

A fully tabulated account is given of field experiments and observations from 1929 to 1936, the results of which showed that in the important wheat-growing regions extending from the Northern Caucasus to the Azoff Sea, certain American (Kansas) wheat hybrids, such as Fulhard, and the Kanred × Fulcaster Nos. 266324, 266319, 266313, and more especially 266287, were outstanding in their resistance to brown rust [*Puccinia triticina*], except in 1931, when one or more hitherto unknown physiological races of the rust made their appearance in the Kuban area, but disappeared later; they also gave high yields. Kanred × Fulcaster 266287 was also normally resistant to *Septoria tritici* and *S. graminum*, and appeared to be well adapted to the local ecological conditions, for which reasons its wider cultivation is advocated over the greater extent of the regions considered, where brown rust is economically the chief wheat disease. It is not suited, however, to the wetter areas, since in 1936 it showed distinct susceptibility to black

and yellow rusts [*P. graminis* and *P. glumarum*] and also an inclination to lodging.

WIEBE (G. A.). **The degree of bunt resistance necessary in commercial Wheat.**—*Phytopathology*, xxvii, 3, 313–314, 1937.

The presence of modifying factors in the composition of certain hybrids resistant to bunt (*Tilletia tritici*) [*T. caries*] having been shown to induce a slight degree of susceptibility to the disease [*R.A.M.*, ix, p. 446], an experiment was conducted at the California University Farm to determine the possible bearing of this phenomenon on the breeding of such lines for commerce. Two strains were used, one from the highly resistant Martin × White Federation (susceptible), and the other from Martin × Sonora (susceptible), the seed being heavily inoculated in 1934 with spores of physiologic race III of *T. caries* [ibid., vii, p. 369] and planted for two successive years without any further addition of inoculum. The bunt percentages in 1934, 1935, and 1936 for Martin × White Federation were 0·8, 0·0, and 0·0 respectively, the corresponding figures for Martin × Sonora being 5·6, 0·4, and 0·0, respectively; for White Federation and Sonora (used as controls) the percentages were 51·8, 63·7, and 65·9, and 78·1, 71·6, and 77·2, respectively. Conditions were favourable for the disease throughout the period of the trials, and it is evidently unnecessary to discard hybrid strains of the foregoing types on account of a commercially negligible tendency to slight infection.

ASHLEY (J. N.), HOBBS (BETTY C.), & RAISTRICK (H.). **Studies in the biochemistry of micro-organisms. LIII. The crystalline colouring matters of Fusarium culmorum (W. G. Smith) Sacc. and related forms.**—*Bio-chem. J.*, xxxi, 3, pp. 385–397, 1937.

The colouring matters present in the mycelium of *Fusarium culmorum*, *F. c.* var. *cereale*, *F. c.* var. *lethaeum* [*F. culmorum*], and of *F. graminearum* [*Gibberella saubinetii*] isolated by G. W. Padwick from wheat in Canada have been investigated. The optimum temperature for development and pigmentation was 24° C. All the forms yielded a brilliant carmine pigment, the colour of which changed to golden-yellow on acid and to purple on alkaline substrata. Two distinct colouring substances were isolated, a crystalline red pigment in the form of glistening plates designated 'rubrofusarin', $C_{15}H_{12}O_5$, m.p. 210°–211°, and the other a golden-yellow, prismatic, micro-crystalline pigment, 'aurofusarin', $C_{30}H_{20}O_{12}$, m.p. above 360°. A third substance, culmorin, $C_{15}H_{26}O_2$, m.p. 175°, consisting of thick, colourless needles, was isolated from one strain of *F. culmorum*.

HYNES (J. H.). **Technical notes. Studies on 'take-all' of Wheat. I.**—*J. Aust. Inst. agric. Sci.*, iii, 1, pp. 43–48, 1937.

In this further account of his studies of *Ophiobolus graminis* in relation to wheat root rot in New South Wales [*R.A.M.*, xiv, p. 622; xvi, pp. 305, 373], the author states that isolation in pure culture is most readily effected by crushing a small portion of a basal wheat sheath bearing mature perithecia and free from soil particles in a drop of sterile water on a glass slide, transferring a loop of spores to a second

drop, and then a further loop to a third drop. A final loop from this last drop is placed in a tube of liquid 2 per cent. dextrose agar at 40° C., and the plate poured and incubated at 25°.

The development of perithecia in artificial culture was very rare, but readily occurred when the moistened butts of diseased plants were kept in Erlenmeyer flasks under laboratory conditions. Six strains of the fungus were differentiated on the basis of colony characters and pathogenicity tests on Hard Federation, Canberra, and Marshall's No. 3 wheat, Algerian and Lachlan oats, Cape barley, and Black Winter rye showed that the six strains were distinct in their effects on the cereals, strains A and B being generally the least and most virulent, respectively, of those tested. Wheat, barley, and oats were very susceptible to infection, while oats were resistant to four of the strains. Under the experimental conditions wheat and oats gave evidence of varietal differences in susceptibility.

STRAIB (W.). **Zur Frage der auf Hordeum murinum L. vorkommenden Rostarten und der Selbständigkeit von Puccinia hordei Fuck.** [A contribution to the question of the rust species occurring on *Hordeum murinum* L. and of the independence of *Puccinia hordei* Fuck.]—*Ber. dtsch. bot. Ges.*, lv, 2, pp. 120–125, 1937.

Puccinia glumarum, *P. graminis tritici*, and *P. hordei* Fuck. [*P. fuckelii*: *R.A.M.*, xv, p. 209] occurred on *Hordeum murinum* in the open in 1936, and the independence of the last-named rust was demonstrated by uredospore inoculation experiments in which it failed to infect rye, wheat, barley, and oats, while conversely its own host was not attacked by *P. dispersa* [*P. secalina*], *P. triticina*, or *P. simplex* [*P. anomala*: ibid., xiv, p. 624, and next abstract]. Specimens of *H. murinum* infected by *P. glumarum* were received from France (physiologic race 33), Chile (30), and Turkey (20).

CHRISTENSEN (J. J.) & DAVIES (F. R.). **Nature of variation in Helminthosporium sativum.**—*Mycologia*, xxix, 1, pp. 85–99, 3 figs., 1937.

In these studies on the nature of the variation commonly occurring in *Helminthosporium sativum* and other dark-spored species of the same genus [*R.A.M.*, xii, p. 782], it was found that the conidia and germ-tubes of *H. sativum* are multinucleate, while the hyphal cells are uni- to multinucleate and the young conidiophores usually uninucleate. All the nuclei in the conidia produced on the same conidiophore may possibly derive from the same nucleus and be genetically alike. True hyphal fusion with the cell walls completely broken down was ascertained to be common between races of *H. sativum*, but rare between *H. sativum* and other dark-spored species of the genus. Pseudo-fusion of the hyphae (hyphal adhesion of Buller) between species of *Helminthosporium* was not unusual.

Cultural comparison of 207 hyphal-tip isolates from 103 germinating conidia from colonies giving rise to variants and from mixed colonies on agar drops showed all the isolates from a single conidium to be identical with the original culture. Similar comparison of 524 conidial isolates from 205 individual conidiophores from mixtures of two races

or species on agar drops or from colonies derived from barley tissues infected with two or more races or species of *Helminthosporium* showed that, with two exceptions, all the isolates from the same conidiophore were culturally identical.

Under certain conditions, particularly when grown on a bacteria-staled medium (50 to 100 c.c. of a dead bacterial culture per l. of potato dextrose agar) most of the progenies from hyphal tips and from conidia gave rise to many variants, either as patches or fan-shaped sectors. One race of *H. sativum* cultured for 17 years yielded 81 varieties from 17 colonies on the staled medium whereas none occurred in 17 control colonies on standard potato dextrose agar. Evidently therefore variation can be induced by environmental factors. No indication was afforded of any stimulus to variation by growing two or more races together on agar or in the host and isolates from mixed cultures sectored no more frequently than the original races. The authors conclude from the evidence obtained that variation in *H. sativum* is primarily due to mutation (gene change or chromosomal aberration) rather than heterocaryosis, though the possibility of the latter is not excluded.

Christensen (J. J.) & Kernkamp (H. C. H.). **Studies on the toxicity of blighted Barley to swine.**—*Tech. Bull. Minn. agric. Exp. Sta.*, 113, 28 pp., 3 figs., 1936. [Received June, 1937.]

Investigations into the toxicity to pigs of barley affected by blight (*Alternaria*, *Helminthosporium*, and *Fusarium* spp.) or scab (*F.* spp., chiefly *F. graminearum* = *Gibberella saubinetii*) [*R.A.M.*, xiii, p. 157; xiv, p. 434] in Minnesota showed that a water extract of 15 gm. of scabbed kernels (*Fusarium* spp.) administered orally by means of a stomach tube induced vomiting in a pig weighing 100 lb., while sterile extracts from scabbed barley injected intravenously and intraperitoneally caused some sickening. Extracts from pure cultures of species of *Fusarium* on various artificial media or on mature barley grain were not toxic to pigs, but pure cultures of *Fusarium*, *Alternaria*, *Chaetomium*, *Penicillium*, *Helminthosporium*, and bacteria grown on steamed barley were refused unless mixed with other food. *G. saubinetii* inoculated into wheat, barley, and maize at grain formation produced a water-soluble, thermostable toxic principle which persisted in barley for at least three years. Barley containing 31 per cent. by weight of blighted kernels (primarily *Helminthosporium* and *Alternaria* spp.) was not toxic to pigs, but the feeding value of sound barley was much reduced when 10 per cent. (by weight) of scabbed (*Fusarium* spp.) kernels were added. Barley naturally infected with 16 per cent. scab was highly toxic to pigs, which refused to eat barley with 32 per cent. scab.

In Minnesota the prevalence of the fungi causing blight or scab varies markedly from year to year and from one locality to another in the same year, scab being most common and destructive in the southern part of the State. Rainfall is the most important factor influencing the type and degree of infection. Many of the most shrivelled and consequently most toxic grains can be removed by fanning or by immersing the grain in water and skimming off the blighted seeds that float on the surface. Some indication was obtained of detoxication

under certain conditions by the addition of milk, starch, and other materials. Soaking and washing the infected grain also removed some of the toxic principle.

Pukhalski (A. V.). Повреждение озимой Пшеницы и Ржи грибком "Склеротиния". [Injury to winter Wheat and Rye caused by the fungus '*Sclerotinia*'.]—*Bull. appl. Bot. Select.*, *1937*, Ser. A, 21, pp. 53–61, 4 figs., 1937.

After giving a brief account of a serious outbreak of *Sclerotinia graminearum* [*R.A.M.*, xv, p. 566] in 1936 on winter-sown wheats and rye in the Kirov [formerly Vyatka] region of the U.S.S.R. and in the Udmurtskaya Autonomous Soviet Republic, which in many cases destroyed whole fields of the two crops, the author states that by germinating sclerotia of the fungus on moistened cotton wool at 6° to 8° C. he succeeded in inducing them to produce apothecia; these vary considerably in shape and size in dependence on environmental conditions, and in particular require moist conditions to mature; the sclerotia require a resting period of four to five months before germinating. Observations indicated that the disease is most severe on poor and insufficiently cultivated soils, and that late winter sowings are the most liable to injury. While no entirely immune variety has yet been found in the wide range of wheats and ryes tested, certain selections from Finland, Sweden, Denmark, Holland, Switzerland, and the United States, as well as local varieties in the north-eastern districts of the U.S.S.R., gave clear indications of relative resistance, which might be increased by breeding.

Zaleski (K.) & Walisiak (J.). **Pleśniaki występujące na ziarnie Żyta i ich znaczenie chorobotwórcze.** [Moulds occurring on Rye grain and their pathological significance.]—*Roczn. Nauk rol.*, xli, 2, pp. 445–452, 1937. [English summary.]

A summarized account is given in this report of laboratory and field experiments to test the germinability and development of rye seed-grain showing infection with moulds and bacteria, or mechanical injury. Carefully controlled isolations showed the presence on the grain of six species of *Penicillium* (including five species which are provisionally considered as new to science, to be described in a future publication), *Fusarium udum* var. *solani* [*F. merismoides*], *F. metachroum* [*F. avenaceum*], *F. subulatum* [*F. avenaceum*], *F. effusum* [*F. avenaceum*], and *F. lucidum* [*F. avenaceum*: *R.A.M.*, xv, p. 643], and *Alternaria tenuis*. They further showed that species of *Penicillium* and bacteria were predominant in seeds exhibiting pink discoloration, instead of species of *Fusarium*, as had been expected. In pot cultures the seed-grain germinated poorly, and gave low yields both in straw and in grain, but in the field it gave normal stands and yields, a possible explanation being that dry conditions prevailed during the two seasons, which did not allow the development of the moulds during the germination of the rye. Further tests showed that treatment of the black- and pink-discoloured grain with two proprietary disinfectants considerably reduced germination, a fact which may be in part attributed to the seed being mechanically injured; it was also experimentally shown that the

preparations had little, if any controlling effect on the fungi, with the possible exception of *Alternaria*, infection by which was reduced from 23 per cent. in the controls to 16·5 per cent. in the treated lots.

McDonough (E. S.). **Primary infection of Setaria italica (L.) Beauv. by Sclerospora graminicola (Sacc.) Schroeter.**—*Phytopathology*, xxvii, 3, pp. 311–313, 2 figs., 1937.

A preliminary note is given on the mode of infection of *Setaria italica* by *Sclerospora graminicola* [*R.A.M.*, xv, p. 646] under experimental conditions simulating those existing in the soil in nature. Seeds of the Siberian variety were covered with oospores of the fungus collected from standing *Setaria viridis* plants and sown on moist cotton in Petri dishes, and at 24-hour intervals from the inception of germination of the seeds material was fixed and examined histologically. The epidermal cells of the root, coleorhiza, mesocotyl, or coleoptile were directly penetrated by the germ-tube or a branch of it. In most cases contact had already been established between the infection hypha and the outer cell wall before the actual occurrence of penetration. For a time the further growth of the fungus was intracellular, but subsequently an intercellular course was pursued. From the root or coleorhiza the pathogen grew into the cotyledonary (scutellary) node and thence into the first internode. Once within the stem the growth of *Sclerospora graminicola* was directed almost exclusively towards the embryonic region, the path taken by the mycelium being either in the cortex or the stele. Ultimately ingress is gained to the young leaves and branches. The results of this study indicate that the primary root and the coleorhiza are the parts of the seedling most commonly affording entrance to the downy mildew fungus.

Baker (R. E. D.). **Citrus scab on Marsh Grapefruit.**—*Trop. Agriculture, Trin.*, xiv, 3, p. 69, 1937.

Citrus scab (attributed on sour orange to *Sporotrichum citri* [*Elsinoe fawcetti*]), hitherto found on Trinidad grapefruit only in isolated instances [*R.A.M.*, xiv, p. 627], was observed in January, 1937, on between 200 to 300 three-year-old Marsh grapefruit trees in the Northern Range area of the island. The fungus was morphologically identical with *S. citri* as found on sour orange, the spores on both hosts measuring 8 to 18 by 2·5 to 5 μ, these measurements agreeing, however, with those given by Miss Jenkins for *Sphaceloma fawcettii scabiosa* [ibid., xvi, p. 169] i.e., 10 to 17 by 2·5 to 5 μ. The outbreak is probably developed as a sequel to abnormally wet weather conditions.

Biraghi (A.). **Notizie e considerazioni su alcuni Agrumi a frutto acido osservati negli Stati Uniti d'America.** [Notes and considerations on acid Citrus fruits observed in the United States of America.]—*Nuovi Ann. Agric., Roma*, xvii, 1, pp. 103–114, 1937.

Notes are given on the characteristics of the various types of lemons and limes (*Citrus aurantiifolia*) and their hybrids seen by the author during a journey made through California and Florida to collect material to be tested for resistance to mal secco (*Deuterophoma*

tracheiphila) [*R.A.M.*, xvi, p. 313] in Italy. The Persian lime, known in Florida as the Tahiti, and in California as Bear's Seedless lime, is hardier than other limes or lemon, and is stated to be immune from scab (*Sphaceloma fawcettii*) [*Elsinoe fawcetti*: ibid., xii, p. 202, and preceding abstract] and anthracnose (*Gloeosporium limetticolum*), though subject to a gummosis, probably of fungal origin, that may affect 10 per cent. of the trees in a plantation, sometimes with fatal results. The Perrine lemon, the result of a cross made in 1909 by W. T. Swingle, between lime and Genoa (Eureka) lemon appeared to be the most promising form found as regards the development of types resistant to mal secco; it is very vigorous, much hardier than lime or true lemon, and immune from scab and anthracnose. The material collected was sent to Italy for further study.

Boron as an essential element in the healthy growth of Citrus.—*Rhod. agric. J.*, xxxiv, 3, p. 166, 1937.

Mature citrus trees on the Mazoe estate, Southern Rhodesia, have long been affected by a condition resulting in so-called 'hard' fruit. The disease, which is slowly progressive, is characterized in its extreme form by marked defoliation, die-back, and small leaves with minute indentations on the ventral surface. Most of the crop is shed between October and December, and the fruits that remain on the tree are commercially valueless by reason of their unshapely appearance and the arrested development of the internal tissues. Gum pockets or corky patches are always present, the absence of juice accounting for the term 'hard' fruit. The condition is aggravated by high temperatures, low humidity, and a soil type allowing rapid drainage. Light applications of borax to the soil have been found by Dr. A. A. Morris of the British South Africa Company to induce a conspicuous recovery in Valencia late [orange] trees in all stages of the disease.

Bates (G. R.). **Report of the Plant Pathologist for the year ending December 31st, 1935.**—*Rep. Brit. S. Afr. Co., Mazoe Citrus exp. Sta., 1935*, pp. 65–72, 1 pl., 1936. [Received May, 1937.]

Further studies in Southern Rhodesia on the infection of oranges by *Penicillium digitatum* [*R.A.M.*, xv, p. 715; xvi, p. 233] showed that perfectly sound, freshly picked fruits can be infected through the cut stem end using an aqueous spore suspension; more infection occurred at 60° F. than at 77°, and at 48° no infection had occurred after six weeks. Fruits wilted for several days beforehand were more resistant than freshly picked fruits, resistance differing with the variety, and ethylene-coloured fruit was generally more resistant than wilted fruit.

The most salient feature of the season's storage tests was the small amount of pitting, nearly all the injury present being of the scald type. The scald markings were pale to rich dark brown, roughly circular, with an irregular margin, and did not pass below the flavedo; in later stages, when the oil vesicles had collapsed, they were sunken. The difference in the types of injury that prevailed in the 1934 and 1935 tests may have been due to different storage conditions, most of the

tests being made at 40° and 48° in 1935 and at 36° and 40° in 1934, while the mean humidities used in the former year were about 65 and 50 per cent. relative humidity as against 75 and 70 per cent. in 1934. The only example of severe pitting found in 1935 was on Valencia oranges stored at 36°; in all the other experiments only traces of pitting occurred at 40° and none at 48°. Pre-storage treatment markedly affected scald development; ethylene-treated fruit developed only a negligible amount of scald under all storage conditions, long-wilted fruit showed very severe scald, injury increasing with increased period of wilting, and freshly picked fruit, especially if unwrapped, was also highly susceptible. Very little decay was due to *P. italicum* and *P. digitatum*. Stem-end, lateral, and centre rots, largely caused by *Colletotrichum gloeosporioides* and *Alternaria citri*, were unimportant during the first ten weeks' storage [ibid., xv, p. 716]. *Diplodia natalensis*, *Phomopsis* [*Diaporthe*] *citri*, and species of *Fusarium* were occasionally isolated.

Paper wrappers containing 8 and 15 per cent. mineral oil gave, respectively, slight and high control of pitting among Valencia oranges stored at 36°, though the former were no more effective against scald than plain sulphite wrappers, and the latter were injurious.

A localized outbreak of die-back among young Premier orange trees associated with concentric ring blotch on the foliage and *C. gloeosporioides* on the twigs, branches, and leaves was successfully controlled by destroying the severely diseased trees and pruning out suspected infections in the remainder.

Inoculations with a normal strain of *Phytophthora citrophthora* isolated from typical gummosis lesions on Washington Navel oranges budded on rough lemon on the Mazoe estate gave positive results in every instance, the fungus being reisolated from the inoculated trees. Infection apparently is active only under certain conditions, usually dying out before seriously affecting the tree.

Psorosis [ibid., xvi, p. 451], one of the most serious diseases of citrus trees in Southern Rhodesia, occurs on the Mazoe estate chiefly on the Valencia Late orange variety, certain groves in the northern section of the estate being most severely affected. In six years' tests with fungicidal remedies not one affected tree has fully recovered, the disease being apparently more virulent locally than elsewhere.

TAMMES (P. M. L.). **De bestrijding van de bladvlekkenziekte bij jonge Klappers.** [The control of the leaf spot disease in young Coconuts.]—*Landbouw*, xiii, 2, pp. 69–73, 1 fig., 1937.

The writer's observations in Java indicate that freedom from grey spot or leaf blight of coco-nuts (*Pestalozzia*) [*?palmarum*: *R.A.M.*, xv, p. 15] may be ensured by the provision of light shade, e.g., *Sesbania grandiflora* cuttings, during the first two years after planting. Such conditions frequently obtain in native plantings, where the seed nuts are kept under shade in the gardens or planted out in maize fields. In a test in 1936 the incidence of infection in shaded plots was only 2 per cent. compared with 46 per cent. in exposed sites. Excessive shade, however, should be avoided as tending to weaken the development of the plants.

Muller (H. R. A.). **Bestrijding van topsterfte.** [Control of top die-back.]—*Bergcultures*, xi, 13, p. 432, 1937.

Some misconceptions are likely to arise through W. Rudin's interpretation of the writer's method of combating top die-back of coffee [*Rhizoctonia*] in Java [*R.A.M.*, xvi, p. 453], the essential feature of which consists in the removal, not only of diseased or suspected leaves, but of the entire branch bearing them. Reasonably deep pruning cuts are necessary for the total excision of infected material, in the recognition of which the coolies rapidly become so practised that mistakes are seldom or never made.

Karpiński (J.). **Próby walki z chrabąszczem (Melolontha sp.) za pomocą grzyba Beauveria densa Pic.** [Experiments on the control of the cockchafer (*Melolontha* sp.) by means of the fungus *Beauveria densa* Pic.]—*Roczn. Nauk rol.*, xli, 2, pp. 383–386, 1937. [German summary.]

The experiments in 1934–5, summarized in this note, showed that under laboratory conditions the cockchafer (*Melolontha melolontha*) was much less resistant to infection with *Beauveria densa* [*R.A.M.*, xv, p. 217] than *M. hippocastani*, as indicated by the length of the relative survival of the two species after infection; in the end, however, all the experimental insects perished, and *B. densa* was recovered from all the bodies. Infected females of the two species either did not lay any eggs at all, or did so very exceptionally, a fact which was confirmed in field experiments. In a forest, in which an infection focus by *B. densa* was artificially established, the percentage of dead cockchafers infected by the fungus was found to be 24·5 within a distance of 1 km. from the focus, 19·2 within the second km., 11·2 within the third, 5·8 within the fourth, gradually decreasing up to the seventh km., where no infected insects could be found. The infection, however, did not penetrate through the soil to the grubs.

Masera (E.). **Action pathogène de bactéries et de champignons entomophytes sur le Bombyx mori L.** [The pathogenic action of entomogenous bacteria and fungi on *Bombyx mori* L.]—*Boll. Sez. ital. Soc. int. Microbiol.*, ix, 1–2, pp. 22–24, 1937.

When three lots, each of ten individuals, of silkworms (*Bombyx mori*) in the fifth larval stage, at which period they are more susceptible to infection, were exposed to the action of a number of entomogenous fungi and bacteria (*a*) by inoculation [method not stated], (*b*) by ingestion of spores on infected leaves, and (*c*) by epidermal contact, the following results were obtained. Inoculation with *Bacillus prodigiosus* [*R.A.M.*, xvi, p. 37] killed all the silkworms in 24 hours, ingestion killed seven in four days, and contact had no effect. With *Coccobacillus acridiorum* [ibid., xvi, p. 251] the corresponding figures were (1) all dead in 48 hours, (2) six dead, two in the cocoon stage, and (3) no effect. *Beauveria bassiana* [ibid., xv, p. 217] killed all the larvae in all three tests, in the cocoon stage. Inoculation with *B. globulifera* [ibid., xvi, p. 456] caused mycosis and death of all ten larvae, while five others died after ingestion and four as a result of contact. *Sporotrichum paranense* [ibid., xvi, p. 250] caused mycosis and death by the inoculation method

only. *Bacillus subtilis* [ibid., xvi, p. 482], *Beauveria densa* [see preceding abstract], *Cephalosporium lecanii* [ibid., xiv, p. 98; xvi, p. 37], *Myriangium duriaei* [ibid., xv, p. 216], and an unidentified *Fusarium* parasitic on the eggs of *Schistocerca paranensis* had no effect. Thus the only organism not previously known to be pathogenic to silkworms found fatal in these experiments was *Sporotrichum paranense.*

Siemaszko (W.). **Studja nad grzybami owadobójczemi Polski.** [Studies on entomogenous fungi of Poland.]—*Arch. Nauk biol.*, vi, 1, pp. 1–82, 3 pl., 7 figs., 1937. [English summary.]

The largest part of this small monograph on entomogenous fungi occurring in Poland is devoted to the genus *Beauveria* which was studied by the author both on Polish material and on cultures received from the Centraalbureau voor Schimmelcultures in Baarn. Of the ten species of *Beauveria* described hitherto as attacking insects, he accepts three, namely, *B. bassiana*, *B. globulifera*, and *B. densa* [see preceding abstracts], each consisting of a number of strains differing from one another in pure culture. Three strains of *B. bassiana* were differentiated in Poland: one on the caterpillar of *Cossus cossus*, the second on the caterpillars of *Carpocapsa* [*Cydia*] *pomonella*, and the third on the beetle *Ortholeura sanguinicollis*; the globose or broadly oval conidia of these strains measured 1·9 to 2·75 (average 2·4) μ for the first, 1·9 to 3 (average 2·36) μ for the second, and 2·2 to 3·3 (average 2·7) μ for the third. None of these strains coloured potato slices and all produced mealy or chalky, flat colonies on both potato slices and nutrient glucose agar. *B. stephanoderis* [*R.A.M.*, v, p. 427] occurring on *Stephanoderes hampei* and other beetles and on Lepidoptera, is stated to be merely a strain of *B. bassiana*. *B. globulifera* is distinguishable from *B. bassiana* by its elevated cottony growth. It occurs on a number of Polish insects in two forms, one of which stains potato slices a vinaceous-purple colour, and the other does not discolour them. The first form includes five strains, one found on *Leptura*, another on *Strophosomus*, and three others on various insects living on or under the bark of trees. The second form comprises two strains, one on *Hylobius abietis*, and the other on *C. pomonella* and other insects. The conidia of all the Polish strains are globose and measure 2·2 to 2·5 μ in diameter. It is considered that *B. effusa* [ibid., xv, p. 217] is not an independent species, but represents a series of strains of *B. globulifera* staining potato a vinaceous-purple; *B. vexans* is also considered to belong to this strain, and *B. delacroixii* (Sacc.) Petch on the migratory locust [*Locusta migratoria migratorioides*] and *B. doryphorae* [loc. cit.] (with 60 per cent. globose conidia) on the Colorado beetle [*Leptinotarsa decemlineata*] are stated to belong to the second form of *B. globulifera*. *B. densa* has elliptical spores and imparts a vinaceous-purple tinge of varying intensity to potato. In discussing the synonymy of this fungus, it is considered that only *Botrytis tenella* and *Isaria densa* can be accepted as definite synonyms of *Beauveria densa*; *Sporotrichum densum* Link is an uncertain species and should be removed from the synonyms. *B. brongniartii* (Sacc.) Petch from the migratory locust is only a strain of *B. densa*.

In giving details of his infection experiments (mostly by dusting the insects with spores), the author states that the bark beetle *Ips*

typographus was successfully infected with spores of *B. bassiana*, *B. globulifera*, and *B. stephanoderis* (culture from Baarn) but not with spores of *B. effusa* (from Baarn) or of *B. densa*. Inoculations with *B. bassiana* and *B. globulifera* were also mostly successful on a number of other insects.

Of the two species of *Spicaria* (*Isaria*) which occur in Poland, *S.* (*I.*) *farinosa* [ibid., xvi, p. 250] is the most common; in agreement with Petch, the author established that this species does not include special forms or strains; in pure culture it is possible to obtain the non-coremial downy forms (*Spicaria*) from the coremial (*Isaria*), and *vice versa*. *S.* (*I.*) *fumoso-rosea* [ibid., xvi, p. 37] was found in Poland on *Melolontha melolontha*, and was shown experimentally to attack easily the caterpillars of *C. pomonella*, *Deilephila euphorbiae*, and *Liparis dispar*. *S. aphodii* Vuill. and *S. cossus* Portier & Sartory, described in 1910 and 1916, respectively, are stated to be synonymous with *S. fumoso-rosea*. *Metarrhizium anisopliae* [ibid., xv, p. 499] was found on *M. melolontha* and *Anomala aenea*, this being the first record of the fungus from Poland.

After briefly considering the problems involved in the control of noxious insects by means of entomogenous fungi, the author terminates with a concise discussion of the posthumous notes by Wanda Konopacka on *S.* (*I.*) *farinosa* and *Cordyceps militaris*, and states that her pencil drawings of the conidial fructifications which she obtained in pure cultures of *C. militaris* clearly show that they cannot be referred to *I. farinosa* [cf. ibid., xvi, p. 250].

The paper is supplemented by a list of 55 Polish and foreign insect hosts and their fungus parasites, and by a second list of entomogenous fungi with their synonyms.

KOBAYASI (Y.). **On the specific connection of Cordyceps entomorrhiza and Tilachlidiopsis nigra.**—*Bot. Mag., Tokyo*, li, 603, pp. 97–102, 2 figs., 1937.

Two specimens of *Tilachlidiopsis nigra* with stromatiferous fruit bodies were found on the ground beneath deciduous trees near Tokyo in 1936. The 50 specimens of the fungus hitherto collected represented the conidial stage only, and advantage was taken of this opportunity for a comparison of *T. nigra* with another parasite of the Carabidae (Coleoptera), *Cordyceps entomorrhiza* (Dickson) Link. The conclusion reached as a result of an examination of the stipe, stromatic heads, perithecia, and conidia of the two fungi is that they are 'connected species' rather than the same species, one being possibly derived from the other.

Full citations to the literature and synonyms are given of *C. entomorrhiza* (syn. *C. cinerea*) [*R.A.M.*, xii, p. 567] and its conidial forms *Stilbella setiformis* and *Hirsutella eleutheratorum* [ibid., xi, p. 573], and of *T. nigra* (syn. *Isaria nigra*) [ibid., ix, p. 524].

SALGUES (R.). **Les propriétés fongicides préventives du bleu de méthylène en pathologie animale.** [The fungicidal preventive properties of methylene blue in animal pathology.]—*C.R. Acad. Sci., Paris*, cciv, 9, pp. 721–723, 1937.

Particulars are given of an epidemic of thrush in white Wyandotte

chickens, caused by *Monilia* [*Candida*] *albicans* [*R.A.M.*, xiii, p. 510; xvi, p. 382], associated in a few instances with *Oidium* [*Oospora*] *lactis* [ibid., xii, p. 371], which was experimentally shown to be preventable by the consumption of wheat grain treated with methylene blue. The same substance, at a strength of 1 per cent., was used with beneficial results on sorghum grain infected by *Cintractia* sp., which had been causing nervous derangements in sheep.

Redaelli (P.), Ciferri (R.), & Cavallero (C.). **Une souche humaine Torulopsis colliculosa (Hartmann) Saccardo.** [A human strain of *Torulopsis colliculosa* (Hartmann) Saccardo.]—*Boll. Sez. ital. Soc. int. Microbiol.*, ix, 1–2, pp. 29–31, 1937.

Examination of *Monilia* [*Candida*] *albicans* C. 337, from the American Type Cultures Collection, Chicago, isolated from the sputum of a tuberculous patient [*R.A.M.*, xvi, p. 484] showed it to have cultural, morphological, and biochemical characters agreeing with those of *Torula colliculosa* Hartmann, renamed *Torulopsis colliculosa* by Saccardo in 1906. The spherical or slightly ovate blastospores average 3 to 4 μ in diameter, and are either separate or grouped in twos or threes in hanging drop cultures. The fungus was found to be capable of fermenting levulose, glucose, mannose, maltose, raffinose and saccharose (slightly), and liquefying gelatine, and was shown by inoculation to be fatal to rabbits. *T. colliculosa* resembles *Saccharomyces lemonnieri*, isolated in France from a human lung affection, in the size and shape of the blastospores, its biochemical and cultural characters, and its pathogenicity to laboratory animals, but it does not produce asci whereas *S. lemonnieri* forms tetrasporous asci.

Van der Veer (A.). **Mold spores in asthma and hay fever.**—Abs. in *J. Allergy*, viii, 3, p. 277, 1937.

A chart of mould counts for the summer of 1936 showed no particular seasonal influence for any of the seven fungi investigated, viz., *Alternaria*, *Aspergillus*, *Hormodendron*, *Monilia* [*Candida*] *albicans*, *Mucor*, *Penicillium*, and *Trichoderma* [*R.A.M.*, xvi, p. 317]. Of 80 patients 13 (16 per cent.) reacted positively by intradermal test to one or more of the moulds in strengths of 100 to 1,000 protein units, the responses, however, rarely being marked and often varying on re-testing. The writer's studies show that mould spores may be implicated in the causation of both asthma and hay-fever, but their exact importance in this connexion cannot be estimated in the light of the knowledge at present available.

Mandlik (G. S.). **A record of rhinosporidial polypi with some observations on the mode of infection.**—*Indian med. Gaz.*, lxxii, 3, pp. 143–146, 1937.

From a study of 48 cases of nasal polypi due to *Rhinosporidium* in the Poona district of India [*R.A.M.*, xvi, p. 462], the writer concludes that infection is localized to contaminated water of wells, tanks, or sections in the course of a river in certain areas divisible into groups; that the fungus is transmitted during the processes of bathing, swimming, or diving; and that the part, if any, played by fish or other

aquatic hosts is uncertain, but that sand and silt probably assist in the conveyance of the organism. The strong affinity for water of the local form of *Rhinosporidium* suggests that it may be a distinct variety of *R. seeberi*.

ERDEN (F.). **Abcès mycosique du poumon par 'Monilia' ('Mycotorula').** [A mycotic abscess of the lung due to *Monilia* (*Mycotorula*).]—*Türk Tib Cemiyetl Mecmuasi*, ii, 9, 8 pp., 4 pl., 1936. [Abs. in *Bull. Inst. Pasteur*, xxxv, 8, p. 388, 1937.]

On the basis of its sugar fermentation reactions, the organism isolated from the sputum of a male patient with a pulmonary abscess was identified as *Mycotorula* (*Monilia*) [*Candida*] *bronchialis* [*R.A.M.*, xv, p. 502], which is believed to have acted in a primary capacity as the agent of the disease.

REDAELLI (P.), CIFERRI (R.), & GIORDANO (A.). **Debaryomyces neoformans (Sanfelice) nobis, n. comb. pour les espèces du groupe Saccharomyces hominis—Cryptococcus neoformans—Torula histolytica.** [*Debaryomyces neoformans* (Sanfelice) *nobis*, n. comb. for the species of the group *Saccharomyces hominis—Cryptococcus neoformans—Torula histolytica.*]—*Boll. Sez. ital. Soc. int. Microbiol.*, ix, 1–2, pp. 24–28, 1937.

In confirmation of Todd and Herrmann's recent identification of 10 strains of the organism conmonly known as *Torula histolytica* or *Cryptococcus hominis* as belonging to *Debaryomyces* (*D. hominis*) [*R.A.M.*, xvi, p. 254], the authors state that examination of 19 strains of *T. histolytica*, the original strain of *C. neoformans*, 3 strains of *C. hominis*, and strains of *C. psichrophilicus* and *T. nasalis* showed the epispore of the ascospores to be verruculose, muriculate, or undulating, a fundamental character of *Debaryomyces*. Conjugation was generally isogamous; ascospore formation took place in the zygote, and empty or emptying ascogonia were noted in the final stage of sporulation, which occurred in ordinary media as well as in hanging drop cultures.

The identification by Lodder and Giordano of *Saccharomyces neoformans* with *C. hominis* and *T. histolytica* [ibid., xiv, p. 694] shows that priority of the specific name of these organisms belongs to *neoformans*. The organisms brought together as *Torulopsis neoformans* (Sanfelice) Redaelli 1931 should now be known as *D. neoformans* (Sanfelice) *nobis* n. comb., additional synonyms of which [ibid., xiv, p. 758] are *C. psichrophilicus*, *C. lithogenes*, *C. meningitidis*, *C. gotoi*, and *C. granulomatogenes*.

SCALFI (A.). **Vasti ascessi delle regioni lombo-iliache da 'Aspergillus flavus'.** [Huge abscesses in the lumbar-iliac region induced by *Aspergillus flavus*.]—*Boll. Soc. med.-chir. Pavia*, l, 3, pp. 339–358, 1 fig., 1936.

Full clinical details are given of an exceptional case of multiple abscesses of enormous dimensions in the lumbar-iliac region in an elderly male patient associated with the presence of *Aspergillus flavus* [*R.A.M.*, xv, p. 20]. The fungus originated in a tubercular condition of the lung,

but it was only on migrating to a fresh site that it acquired the specifically pathogenic character described.

LÉON-KINDBERG (M.), PARAT (M.), & NETTER (H.). **Tumeur mycosique du poumon (aspergillose pulmonaire primitive pseudo-cancéreuse).** [A mycotic tumour of the lung (primary pseudo-cancerous pulmonary aspergillosis.)]—*Pr. méd.*, xliv (ii), 92, pp. 1834–1837, 9 figs. (4 col.), 1936.

The fungus associated with a fatal case of primary pulmonary aspergillosis, simulating cancer, in a 41-year-old-man, is tentatively identified as a species of *Aspergillus* allied to *A. bouffardi* Brumpt.

VOLFERZ (GALINA). **Causal agents of mycosis among the children of Saratov.**—*Rev. Microbiol., Saratov*, xv, p. 77, 1936. [Abs. in *Bull. Inst. Pasteur*, xxxv, 8, p. 395, 1937.]

Of 1,688 children, aged 1 to 14 years, whose hair, skin, and nails were examined at Saratoff [U.S.S.R.] for the presence of mycoses [*R.A.M.*, ix, p. 313 *et passim*], 45·6 per cent. yielded positive results. Trichophytosis predominated (97·6 per cent. of the total), represented by *Trichophyton violaceum* (67·2 per cent.) [ibid., xvi, p. 459], *T. crateriforme* (14) [ibid., xvi, p. 458], *T. gypseum* 10·8), *T. faviforme* (3·6) [ibid., xiii, p. 701; xv, p. 296], and *T. niveum* (0·4) [ibid., xv, pp. 222, 501], *Achorion schoenleini* being isolated from only 0·8 per cent. of the available material.

COOK (M. D.) & GRAHAM (R.). **Favus (Achorion muris) infection of mice.**—*J. Amer. vet. med. Ass.*, lxxxix, 3, pp. 321–323, 4 figs., 1936.

A fungus isolated from the scalp of a mouse naturally infected with favus was characterized on wort agar by luxuriant, velvety, white colonies and a septate, concatenate mycelium, and was identified by C. W. Dodge as *Achorion quinckeanum* [*R.A.M.*, xiii, pp. 164, 237; xv, p. 501]. It was inoculated into a healthy mouse with positive results.

BENDIXEN (H. A.). **A study of the churn cleaning methods used by plants producing butter of various yeast and mold counts.**—*J. Dairy Sci.*, xx, 1, pp. 15–25, 1937.

From a study of the methods of churn treatment employed by seven butter-producing plants in the State of Washington, the following factors would appear to be significant in the reduction of the yeast and mould incidence [see next abstract]: (1) the use of ample quantities of wash water (at least $\frac{1}{3}$ to $\frac{1}{2}$ the capacity of the churn); (2) a high temperature (180° to 200° F.) of the water; (3) the use of 0·1 to 0·2 per cent. washing powder solution to remove grease, enhance germicidal capacity, and improve odour; (4) washing or rinsing with an alkaline crystalline hypochlorite solution of about 50 parts per million together with hot-water treatment; (5) keeping the hot water in contact with the revolving churn for at least 15 mins.

Considering individual samples, no direct relationship was found between yeast and mould counts and the quantity and keeping properties of the butter held for one month at 36° to 41°, but when grouping the plants according to their median yeast and mould counts,

the average scores of each group, both for fresh and stored butter, decreased and the average score losses during storage increased parallel with a rise in the yeast and mould incidence.

WILDMAN (J. D.). **Development of methods for the estimation of mold in cream or butter.**—*J. Ass. off. agric. Chem., Wash.*, xx, 1, pp. 93–100, 3 graphs, 1937.

A microscopic method for the estimation of the extent of mould [unspecified] mycelium in butter [*R.A.M.*, xv, pp. 154, 454] and a simple macroscopic means for the detection of similar contamination in cream are described. The procedure for the butter tests is as follows: to 1 gm. of butter 7 c.c. of hot carob bean gum solution (0·75 per cent.) is added and the solution is stirred until well mixed and the fat globules 0·1 to 0·2 mm. in diameter; a portion is then mounted on a mould-counting slide and the incidence of mould estimated by the Howard method (Methods of Analysis, Association of Official Agricultural Chemists, p. 500, 1935), whereby a field is reckoned as positive if the combined length of the two largest fungal filaments exceeds $\frac{1}{6}$ of the diameter of the field. Cream is tested as follows: 5 gm. are weighed out and 15 c.c. of a hot methylene blue-borax solution added (30 gm. sodium borate and 10 methylene blue tablets in 1 l. water); after three minutes' stirring the mixture is filtered through a perforated brass funnel, No. 26 gauge with 625 holes per sq. in., each 0·02 in. in diameter, more solution being added to wash any mould clots into the apex of the funnel. With a dissecting needle the top of the mould is levelled off to form an inverted cone, the diameter of the base of which is measured in mm.

The following are the principal points brought out in the development of the procedures. In the dairies inspected in the eastern and central States infection was generally so well distributed throughout the churn that the data for one sample by the microscopic method were considered to be representative of the whole churning. The majority of the cream samples from individual farmers' lots were relatively free from mould except during the hot summer months and the autumn, when infection from this source increased. The mould mycelium in cream was largely retained in the butter on churning. The methylene blue-borax test made possible the detection of cream samples containing excessive amounts of mould, 97 per cent. of which had abnormal flavours.

VERNON (T. R.). **The mycology of dairy products.**—*Dairy Ind.*, i, 1, pp. 21–22; 2, pp. 56–58; 4, pp. 125–126, 4 figs., 1 graph, 1936; ii, 2, pp. 63–65; 4, pp. 133–135, 6 figs., 1937.

This is a popular account of the writer's investigations on the mycology of dairy products (including butter boxes and parchment wrappings), technical papers on which have been noticed from other sources [*R.A.M.*, xiv, p. 761].

KOTTHOFF (P.). **Neue Topfpflanzkrankheiten.** [New pot plant diseases.] —*Kranke Pflanze*, xiv, 2, pp. 28–30, 2 figs., 1937.

Fusarium moniliforme [*Gibberella moniliformis*] was isolated from

circular, sunken, reddish-brown, yellow-bordered lesions, 1 cm. in diameter, on leaves of *Sansevieria zeylanica* plants in pots, and inoculated into healthy foliage through wounds with positive results. The centres of the spots shrivel and fall out, imparting a shot-hole appearance to the foliage and rendering the plants unmarketable. Control should be based on the removal of diseased material and the repeated treatment of the plants with a copper-containing fungicide, such as 1 per cent. Burgundy mixture or nosperit.

Phytophthora cactorum is the agent of a soft, dark brown to black rot of the stem and branches of *Kalanchoë globulifera* var. *coccinea* extending from the collar upwards to the leaf blades and downwards to the roots and involving the tissues from the cortex to the xylem. In one nursery 25 per cent. of the plants were destroyed by the fungus, which is believed to have been introduced with beech leaf mould, since beech seedlings grown in sand inoculated with the *Kalanchoë* strain of *P. cactorum* rapidly succumbed and presumably the *Phytophthora* on beech commonly referred to *P. fagi* [*R.A.M.*, xiii, p. 605] (regarded by many authors as identical with *P. cactorum*) can pass to *Kalanchoë*. The soil should be sterilized with uspulun or formalin or by heat, and mildly affected plants sprayed with 0·25 per cent. uspulun.

Schmidt (H.). **Eine Blattfleckenkrankheit an Pelargonien (Erreger: Macrosporium pelargonii).** [A leaf spot disease of Pelargoniums (causal organism: *Macrosporium pelargonii*).]—*Kranke Pflanze*, xiv, 3, pp. 50–51, 1 fig., 1937.

Zonal pelargoniums [*Pelargonium zonale*] in the Pillnitz [Saxony] Palace Park were destructively attacked in May, 1936, by *Macrosporium pelargonii* [*R.A.M.*, xv, p. 442], the agent of a foliar disease characterized by circular, zonate, brownish lesions, surrounded by a well-marked ridge, and tending to enlarge or become confluent. The Köchlin Black variety was most severely affected, but the pink Souvenir de la Rocque was also involved to a lesser extent. Control measures should include the use of cuttings from healthy mother-plants, change of beds (to guard against the possibility of soil infection), and prophylactic treatment with Bordeaux mixture.

Nicolas (G.) & Aggéry (Berthe). **Maladies bactériennes du Begonia.** [Bacterial diseases of the Begonia.]—*C.R. Soc. Biol., Paris*, cxxiv, 10, pp. 900–903, 1937.

Begonia gracilis in Toulouse conservatories suffers from two bacterial diseases. One is a systemic disturbance, beginning with a marginal chlorosis and wilting of the foliage which gradually extends inwards to the petiole, involving the shedding of the leaves and the dropping of the flowers before opening in consequence of the desiccation and basal blackening of the peduncle. The newly formed shoots are pale green and the leaves fall rapidly, so that the plants assume a stunted, somewhat bushy appearance.

The second disorder, which may aptly be termed 'smallpox', is of a milder character on *B. gracilis*. Localized sunken, greenish-brown, irregular lesions appear along the leaf margins; sometimes the parenchyma shrivels but the leaves do not fall. The flowers open but are

rapidly shed. *B. semperflorens* is attacked by this disease in a severe form.

The organism responsible for the desiccation of *B. gracilis* occurs singly or in chains of two to five in the form either of very short (0·2 to 0·3 μ) Gram-negative rods or of larger Gram-positive ones (2 to 4 by 1 to 1·5 μ). Gelatine is liquefied by the two forms in association. The 'smallpox' bacterium measures 0·5 μ in length and often occurs in chains of two or three; it is Gram-negative and liquefies and discolours gelatine.

Positive results were given by inoculation experiments on *B. schmidtiana* with cultures of the desiccation disease from *B. gracilis* and with those of 'smallpox' from *B. semperflorens*.

Baldacci (E.). **Il mal dell' Oidio sopra la Photinia serrulata Lindl.** [*Oidium* disease on *Photinia serrulata* Lindl.]—*Costa azzur. agric.-flor.*, xvii, 2, pp. 29–30, 2 figs., 1937.

In the spring of 1936, *Photinia serrulata* plants at Forlì, Italy, became infected by *Oidium leucoconium* [*Sphaerotheca pannosa*], the attack being confined mainly to the young leaves of the apical shoots. This appears to be the first record of the fungus on this host [cf. *O. photiniae* Jacz. (?*Podosphaera leucotricha*) recorded on *P. serrulata* in Italy by Peglion: *R.C. Accad. Lincei*, xxv, 1, 5, p. 341, 1916].

O'Leary (K.) & Guterman (C. E. F.). **Penicillium rot of Lily bulbs and its control by calcium hypochlorite.**—*Contr. Boyce Thompson Inst.*, viii, 5, pp. 361–374, 1 fig., 1937.

A tabulated account is given of experiments from 1931 to 1936, inclusive, on the control of the cold storage rot of lily bulbs in the United States caused by a species of *Penicillium* [*R.A.M.*, x, pp. 668, 776; cf. also xiii, p. 381], which appears to belong to Westling's *P. cyclopium* group (*Arkiv Bot.*, xi, pp. 1–156, 1912). The rot develops at temperatures just above the freezing point; it begins as small brown spots on the scales or basal plate of the bulb, which enlarge slowly at low temperatures, and become depressed; the centres are covered with a white mycelial growth which assumes a light dull glaucous blue due to the conidia. The affected area extends to the whole scale and then to the basal plate or adjacent scales. Bulbs exhibiting slight attack on the outer scales usually develop normal plants and are found to be free from the fungus the next autumn, but if the infection occurs in several of the inner scales near the bud, no plant is produced. *Lilium rubellum*, *L. japonicum*, and *L. auratum* are susceptible to the disease, *L. speciosum* less so, and *L. longiflorum* but slightly susceptible. The causal fungus was isolated and its pathogenicity established; it was able to rot bulbs at 3° C., the optimum was 10°, and no rotting occurred at over 28°.

In the experiments described poor or no control was obtained with sulphur dust, copper-lime dust, formaldehyde in liquid and dust form, borax solutions, by the use of plain fruit wrappers or wrappers treated with copper or mercury compounds, or, lastly, by removing the roots from the bulbs before packing. Organic and inorganic mercury dusts, while fairly effective against the rot, were highly toxic to the lilies, and naphthalene flakes discoloured the bulbs. In the 1935–6 tests excellent

control of the rot, without undue injury to the bulbs, was obtained by mixing calcium hypochlorite powder (20 to 27 per cent. available chlorine) with the packing soil at the rate of 160 gm. of powder to 50 lb. of soil; the bulbs were placed in cold storage for four and a half months after shipment from Japan, when 78 per cent. of the treated bulbs were found to be first grade (free from rot), 20 per cent. second grade (with one to five outer scales rotted), and 1 per cent. third rate (with more than five scales rotted). Calcium hypochlorite at the same concentration also controlled the bulb mite (*Rhizoglyphus echinopus*).

Shcherbak [Shtsherbak] (S.). Селекция Подсолнечника на устойчивость к ржавчине. [Breeding the Sunflower for resistance to rust.] —*Bull. appl. Bot. Select.*, *1937*, Ser. A, 21, pp. 67–76, 2 graphs, 1937.

After briefly indicating the very considerable economic losses caused by the sunflower rust (*Puccinia helianthi*) [*R.A.M.*, xvi, p. 184] in the U.S.S.R. [where sunflower seed is extensively used for the industrial production of oil and also for human consumption], the author gives a concise review of the previous attempts, by selfing resistant individuals or by interspecific crosses, to breed a rust-resistant strain of the plant, all of which have failed hitherto. A new attempt is now being made by inbreeding certain varieties or lines of the sunflower which previous observations had shown to exhibit a degree of field resistance, such as No. 314, Fuchsinka, and Tchernyanka. The results of three years' work, although admittedly preliminary, are encouraging in that the original resistance of the inbred families has been markedly increased in each consecutive generation, as shown, for instance, by the fact that in the F_3 generation of Fuchsinka 10 the intensity of the rust in the greenhouse was reduced by from 36 to 48 per cent. (from 4·5 to 3 to 2·5 by the usual 5 marks scale to measure rust intensity). Inbreeding from individually resistant plants was shown to be impracticable, because of the recessive nature of the factors for resistance.

Berkner (F.). **Thielavia basicola, eine Gefahr für den Leguminosen-Zwischenfruchtbau?** [Does *Thielavia basicola* constitute a menace to leguminous crop rotation?]—*Pflanzenbau*, xiii, 9, pp. 321–334, 12 figs., 3 diags., 1937.

In the course of observations in Silesia on the compatibility of certain legumes in the crop rotation succession, the fourth consecutive stand of yellow lupins (*Lupinus luteus*) was found to be severely attacked in 1936 by *Thielavia* [*Thielaviopsis*] *basicola* [*R.A.M.*, xv, pp. 101, 536]. The plants were extensively wilted and the roots of the older ones rotten and much blackened; secondary infection by *Fusarium* spp. had occurred. *T. basicola* also infected *L. angustifolius*, field peas, and *Vicia villosa*. The conditions stimulating the fungus to such intense parasitic activity, in contrast to its normally saprophytic habit, are unknown, but they may include the absence of decaying organic matter in the soil, which has received no stable manure for at least ten years, and the secretion by the lupin roots of some metabolic product imparting a pathogenic character to the organism. The existence of a physiologic race adapted to legumes, and especially to *L. luteus*, appears to be indicated.

Hey (A.), Klinkowski (M.), & Richter (H.). **Der Stengelbrenner (Anthraknose) der Serradella.** [The stem-burner (anthracnose) of Serradella.]—*NachrBl. dtsch. PflSchDienst*, xvii, 3, pp. 23–24, 1 fig., 1937.

Serradella (*Ornithopus sativus*) crops in East Pomerania, Grenzmark, and Neumark were observed in July, 1936, to be suffering from a hitherto unknown disease associated with dark bluish-brown, somewhat sunken lesions partially or entirely girdling the stems, and more or less severe wilting, culminating at an advanced stage in the collapse of the plants above the site of attack. The root-collar, stem base, and basal shoot axes may also be involved, in which case the entire plant rapidly succumbs. Infection was most prevalent (up to 90 per cent. of the stand) in low-lying or overshadowed situations, where the loss of fodder was reckoned at 40 to 70 per cent. In one locality a stand sown in June was almost free from infection, whereas another in the vicinity planted at the normal time in April, was 90 per cent. diseased. *Colletotrichum trifolii*, first observed on lucerne in Germany in 1933 [*R.A.M.*, xiii, p. 382], was isolated from the wilted material and inoculated with positive results into *O. sativus* and *O. compressus*.

Furneaux (B. S.) & Kent (W. G.). **'The death': a trouble of fruit trees due to root suffocation.**—*Sci. Hort.* (formerly *H.E.A. Yearb.*), v, pp. 67–77, 2 pl. [facing pp. 52, 53], 2 figs., 1937.

In 1936, large numbers of fruit trees and bushes in south-eastern England collapsed and died as a result of a well-known condition referred to locally as 'the death'. The usual symptoms on fruit trees are that the leaves remain small, turn yellow, and wilt, while the terminal shoots either make no growth or also wilt; collapse rapidly sets in, though a partial recovery may be made. Fruit bushes either die before making any growth, or after producing weak, scorched side growths. In all cases the roots were wholly or partially dead and emitted an alcoholic odour. Two forms of the trouble occurred, i.e., 'regional death' in which blocks of trees and bushes were affected, and 'wind-rocking death' which affected only individual trees. In the former type of trouble the whole root system was dead under a certain level, due to the soil being waterlogged. In 'wind-rocking' death the base of the stem was dead from or just under ground-level, and the main roots had been killed to a distance of 12 to 18 in. outwards from the stem. The swaying of the trees had produced cavities in the soil, and these had become filled with rain, the resultant lack of aeration killing the roots. Hosts susceptible to the condition included apples (to both types), plums, cherries, raspberries, gooseberries, pears, blackberries, and loganberries, 'the wind-rocking' form affecting tree fruit only, except for one case in raspberries.

Kidd (F.) & West (C.). **The keeping qualities of Apples in relation to their maturity when gathered.**—*Sci. Hort.* (formerly *H.E.A. Yearb.*), v, pp. 78–86, 8 graphs, 1937.

In this general account of their studies on the storage behaviour of Bramley's Seedling apples [cf. *R.A.M.*, xvi, p. 185] picked at different times between mid-September and mid-October the authors found that

the more mature the fruit when placed in cold or gas storage the more rapidly do fungal wastage, breakdown, and scald of the senescent type develop. The earlier apples are gathered, however, the more liable are they to develop superficial scald and the longer apples are kept at ordinary temperatures before being placed in cold storage the less susceptible they become to this disorder [ibid., xvi, p. 233]. Fruit placed in cold storage after the climacteric did not develop scald, which, except with very susceptible varieties, such as Newton Wonder and Annie Elizabeth, can usually be controlled by oiled wrappers [ibid., xvi, p. 260]. The volatile substances responsible for superficial scald may be liberated months before the trouble becomes visible, and the wrappers effect control chiefly during this period. Clear evidence was recently obtained that apple tissues break down most rapidly when the fruit is put into cold storage at the peak of the climacteric. Though bitter pit [ibid., xvi, p. 325] in the case of Australian and New Zealand apples is much more serious on immature fruit than fruit picked later in the season, experiments with several English apple varieties indicated that the maturity of the fruit when gathered has little or no effect on the development of the condition in cold or ordinary storage.

From a consideration of all the factors discussed in this article the authors conclude that apples should be gathered during the fortnight just before the beginning of the climacteric.

WINKELMANN (A.). **Spritztermine für die Fusikladium Bekämpfung.** [Spraying schedules for *Fusicladium* control.]—*NachrBl. dtsch. PflSchDienst*, xvii, 2, pp. 9–13, 3 graphs, 1937.

Three years' spraying experiments (1934 to 1936) in the Lower Elbe district of Germany showed that apple scab (*Fusicladium*) [*Venturia inaequalis*: *R.A.M.*, xvi, p. 470 and next abstract] may be effectively combated by three applications of a copper-containing preparation, the first being given as soon as the ascospores on the leaves reach maturity, provided rain is expected during the next few days and the trees have attained the critical stage of development for infection (end of March under local conditions during the period of the tests), the second about 20th, and the third from 25th to 30th April; in 1934 a fourth treatment on 10th May would have been desirable. Further applications should be unnecessary if the spread of the ascospores has been properly checked, but a re-examination of the leaves by Holz's method [ibid., xv, p. 661] from time to time is advisable to guard against accidents which might permit the extension of the disease through the conidia.

The results obtained by Osterwalder in Switzerland with his 'blue spray' (4 to 6 per cent. Bordeaux mixture applied to dormant trees) [ibid., xvi, p. 388] are briefly discussed and considered to fall short of German requirements.

LOEWEL (E. L.). **Der Erfolg der Schweizer und der Altländer Spritzfolge gegen Fusikladium. Dreimalige oder sechsmalige Spritzung gegen Fusikladium.** [The result of the Swiss and Altland spray schedules against *Fusicladium*. Three or six applications against *Fusicladium*.]—*Obst- u. Gemüseb.*, lxxxiii, 3, pp. 36–37, 1937.

Experiments were carried out in north Germany in 1936 to determine

the efficacy under local conditions of Osterwalder's 'blue' spraying schedule against apple scab (*Fusicladium*) [*Venturia inaequalis*: see preceding abstract] in comparison with that normally followed in the Altland. The following treatments were given: 1 ('blue' schedule), 5 per cent. veralin (carbolineum) on 10th March, 6 per cent. Bordeaux on 24th, and 1 per cent. sulfo (double-strength lime-sulphur) on 25th May, with a supplementary application (to late-ripening varieties only) of 1 per cent. sulfo on 17th August; 2 (Altland schedule), carbolineum at the end of February, 2 per cent. copper-lime at the time prescribed for the Swiss 'blue' spray, 1 per cent. of a copper-arsenic compound shortly before flowering, 2 per cent, lime-sulphur plus 1 per cent. lead arsenate paste shortly after flowering and again a fortnight later, and 0·25 per cent. copper-lime at the beginning of August. Fairly good results (by Swiss standards) were obtained with the 'blue' schedule on early varieties, but the protection afforded to late apples, such as Boiken (only 6·4 per cent. healthy), Orleans Reinette (4·6 per cent.), and London Pippin (23·1 per cent.), was totally inadequate; 76·3 per cent. of the Boikens treated by the Altland schedule were entirely scab-free.

Hamilton (J. M.). **Recent investigations on the control of Cedar-Apple rust in the Hudson Valley.**—*Bull. N.Y. St. agric. Exp. Sta.* 678, 34 pp., 8 figs., 1937.

After briefly reviewing the life histories of *Gymnosporangium juniperi-virginianae* [*R.A.M.*, xvi, p. 190], *G. globosum* [loc. cit.], and *G. clavipes* [loc. cit.] and discussing their relative importance in the cedar-apple rust problem in the Hudson Valley, the author states that the danger from apple foliage infection by *G. juniperi-virginianae* extends locally from 1st May to the latter part of June, the period for apple fruit infection by the same fungus being mostly confined to May.

In comparative field spraying tests against *G. juniperi-virginianae* perfect control was obtained only when the applications immediately preceded the wetting periods that induced the infection. Both lime-sulphur and Bordeaux mixture effectively prevent rust infection but are liable to cause injury. In the experiments recorded consistently good results were given by Camden flotation sulphur paste (6 or 8 in 100 and even 3 in 100 in one test) (containing 35 per cent. sulphur with iron-oxide added; Camden Coke Plant, Camden, N.Y.) and kolofog (6 in 100); Koppers flotation sulphur paste (6 in 100) gave results as good as the Camden paste in one experiment but was slightly less effective in another. Koppers dry-wettable flotation sulphur (5 in 100) gave good control under average conditions, but was less satisfactory in serious outbreaks; it was improved by the addition of orthol-K Ready-mix oil which increased the adhesiveness. Mulsoid sulphur (6 in 100) (a crude ground sulphur manufactured by Sherwin Williams Co., Cleveland, Ohio) varied widely in efficacy, and magnetic spray (6 in 100) (a wettable sulphur prepared by National Sulphur Co., New York) was as effective as Koppers dry-wettable sulphur in the less severe tests. Mike sulphur (3 and 5 in 100) (a wettable sulphur of the Dow Chemical Co., Midland, Mich.) gave excellent control in a single test with orthol-K Ready Mix oil added. Bordeaux mixture

(2–3–100) was effective, but not coposil (2–3–100) or ZO (1–1½–100) [see below, p. 544]. Prompt and thorough spraying appeared to be more important than the strength of the materials used.

Suggestions are made for adapting the data obtained to commercial practice and combining the rust sprays with the usual programme against scab [*Venturia inaequalis*], e.g., by spraying against rust between the early petal-fall scab spray and the 10-day spray, and again between the last-named and the codling moth [*Cydia pomonella*] spray. If proper spraying equipment is unavailable and the eradication of *Juniperus virginiana* impracticable, susceptible apple varieties should be replaced by resistant ones such as Milton, McIntosh, and Cortland.

Diachun (S.). **Some effects of the environment on the spongy dry rot of Apples.**—*Phytopathology*, xxvii, 2, pp. 203–206, 1937.

A close similarity has been observed to exist between the common black rot of apple (*Sphaeropsis malorum* Peck) [*Physalospora mutila: R.A.M.*, xv, p. 726] and the spongy dry rot (*Volutella fructi* Stev. & Hall = *Colletotrichum fructus* [(Stev. & Hall) Sacc.] sensu M[aud] M. Duke) [ibid., viii, p. 268] under conditions of low relative humidity (40 per cent.) preventing the formation by the latter fungus of setose acervuli. In greenhouse inoculation experiments with aqueous suspensions of *C. fructus* on Grimes Golden, Willow Twig, and Jonathan fruits, and on twigs and leaves of the first-named variety, a high degree of atmospheric humidity was found to be requisite for the production of acervuli on the fruits and the development of foliar symptoms not previously reported in nature. The leaves appear to be penetrated directly through the epidermal layer. Spongy dry rot is stated to be prevalent in widely scattered regions of the United States, and may cause considerable damage under favourable conditions.

Borzini (G.). **Il 'mal del piombo' del Pero in Italia.** [Silver leaf disease of Pear in Italy.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvi, 4, pp. 217–224, 1 pl., 5 figs., 1 plan, 1936. [Received May, 1937.]

During 1936 pear trees in various parts of Lombardy showed symptoms of silver leaf disease accompanied by unproductivity, and frequently by chlorosis, wilting, and rolling of the leaves. The disease is regarded as the same as that recently reported by Goidànich [*R.A.M.*, xv, p. 446] and the development of sporophores at the collar of severely diseased plants enabled the fungus involved to be identified as *Stereum purpureum*. The condition appeared to be of a serious nature only in one locality periodically subject to waterlogging. The Passa Crassana variety was the most susceptible and Duchessa d'Angoulême highly resistant or immune, while Bergamotta Espérèn and Butirra Clairgeau have so far remained unaffected. Further investigations are in progress.

Hutchins (L. M.), Bodine (E. W.), & Thornberry (H. H.). **Peach mosaic, its identification and control.**—*Circ. U.S. Dep. Agric.* 427, 48 pp., 31 figs., 1 graph, 1937.

This is a summary of the available knowledge of peach mosaic

[*R.A.M.*, xvi, p. 329], now known to occur in Texas, Colorado, California, Utah, New Mexico, and Arizona. The manifestations of the disease differ with the variety affected, one or more of the following symptoms affording clues of identification: 'breaking' of flowers (conspicuous in Carman, Chilow, and Early Wheeler), retarded spring leafage, variously mottled and deformed foliage, twig abnormalities, and fruit malformation. The incubation period of the disease following grafting is also variable, but spring inoculations are likely to result in the appearance of symptoms during the same growing season. Symptoms resembling those of peach mosaic have occasionally been observed on almonds, apricots, cherries, and plums [see above, p. 518] growing in the vicinity of peach orchards. The virus is not communicated from diseased to healthy trees by irrigation water, pruning implements, or other mechanical contacts, through the soil, or (in preliminary tests) by pollination with viable pollen, yet under favourable conditions its contagiousness is so great that the commercial value of an entire planting may be destroyed in three to six years. Vigorous eradication measures are proving effective in Colorado.

Cation (D.) & Rasmussen (E. J.). **Comparisons of some old and new materials for spraying Cherries.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xix, 3, pp. 123–142, 9 figs., 1937.

In comparative spraying tests carried out by D. Cation in Michigan from 1934 to 1936, inclusive, for the control of cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xv, p. 2] under conditions favourable to disease development, red copper oxide containing 86 per cent. copper (½ to 2 in 100); cupro K, a compound of copper oxychloride containing 25 per cent. copper (4 to 6 in 100); ZO, a copper zeolite compound containing 25 per cent. copper (4 and 5 in 100); Oxo-Bordeaux [ibid., xiii, pp. 267, 358] containing 12½ per cent. copper (6 and 8 in 100); and Bordeaux mixture (4–6–100 and 6–8–100) all gave good control, though high calcium Bordeaux mixture and red copper oxide were excessively injurious. Cupro K, ZO, and Oxo-Bordeaux (especially the first) gave markedly better control than lime-sulphur (1 in 40) when long periods elapsed between the applications or when few applications were made. The copper sprays showed a tendency to kill the fungus in established infections without causing defoliation. Infected leaves sprayed with lime-sulphur turned yellow in a few days and fell.

Experiments by the second author on the influence of fungicides on cherry trees and fruits in an orchard comparatively free from leaf-spot infection showed that trees given thorough applications of lime-sulphur at the correct times retained their foliage better, gave larger yields and larger fruit and showed a greater increase in trunk circumference and shoot growth than trees sprayed with high calcium-lime Bordeaux mixture, of which the 4–8–100 formula gave the least defoliation. Trees sprayed with Cupro K, ZO, and Oxo-Bordeaux gave comparable yields of comparably sized fruit with trees sprayed with lime-sulphur, but finally showed greater defoliation. Growers who obtain good leaf-spot control with lime-sulphur should continue with this spray. The new copper compounds are promising enough for limited trial, but only if applied with care.

Löhnis (Marie P.). **Ziekteverschijnselen bij Aalbessen veroorzaakt door de minerale voeding.** [Pathological symptoms in Red Currants induced by mineral nutrition.]—*Tijdschr. PlZiekt.*, xliii, 2, pp. 33–58, 4 pl., 10 figs., 1937. [English summary.]

It was ascertained in the course of pot and field experiments on mineral nutrition in relation to pathological conditions of red currants that a characteristic rusty- to purplish- or greyish-brown discoloration of the leaves may be induced by chlorine ions (0·005 to 0·03 N), sodium chloride being more injurious in this respect than potassium or calcium chloride. It was further observed that potassium deficiency may result in the development of sharply delimited, dark purple lesions scattered over the leaves, as well as in the familiar marginal scorching [*R.A.M.*, xiii, p. 173]. Boron deficiency caused a brown discoloration, shrivelling, and blackening of the petiole of the youngest leaflet, while the neighbouring leaves were edged with a wide, dry, light brown band, leaving only a narrow central zone green. This condition was not observed in the open. At concentrations of 0·02 and 0·03 N sodium and potassium sulphate, and in a few instances nitrate, induced in pot tests only a reddish-purple to reddish-brown marginal discoloration, accompanied by curling of the edges and the development of alternating zones of discoloured and green foliar tissue.

Adams (J. F.). **Report of the Plant Pathologist for 1936.**—*Bull. Del. Bd Agric.*, xxvii, 1, pp. 3–15, 1937.

In this report, which is on the same lines as those for previous years [*R.A.M.*, xiv, p. 496], it is stated that during the spring of 1936 many plantings of Blakemore strawberries in Delaware showed yellowing, the incidence ranging from a trace up to 90 per cent. Many of the plantings recovered completely, though severely affected plants made very little growth and set few or no fruits. The condition appears to have been due to some weakness in propagating ability peculiar to the variety.

Stahel (G.). **Banana leaf spot (Cercospora musae).**—*Trop. Agriculture, Trin.*, xiv, 3, pp. 59–60, 1937.

A preliminary resumé is given of the results obtained in a comprehensive investigation into banana leaf spot (*Cercospora musae*) [*R.A.M.*, xiv, p. 45; xvi, p. 156] in the West Indies and Surinam where the disease has since 1933 and 1934, respectively, become increasingly prevalent, and is causing serious losses. The fungus penetrates the lower surface of the leaf, inoculations on the upper surface giving at most only insignificant infection. Only the two youngest leaves are highly susceptible, though generally free from spots; on leaves older than the third even a concentrated emulsion of the conidia produced only weak, if any, infection. The germ-tube passes the first four to six days on the leaf surface, enters a stoma, and progresses along the inside surface of the large air chamber to the palisade tissue, where the hypha branches and grows intercellularly between the palisade cells. This mycelium remains, however, sparse. Spread then takes place to the neighbouring air chambers up to the veins, and the palisade tissue turns

yellow-green. Penetration of the veins is difficult, and the mature streaks often consist of one internerval space, though in other cases the streak is accompanied by one or two shorter streaks along the sides.

The first symptoms (minute yellow-green speckles the size of an air-chamber) appear 15 to 17 days after inoculation (11 days after penetration of the stomata). A week later the speckles have lengthened out into streaks 8 to 10 mm. long, and appear to be covered by rust; the fungus grows out through the stomata in the streak and spreads for 2 or 3 mm. round it, chiefly on the lower surface of the leaf. Two or three days later a toxic effect is produced on the tissue under the mycelium, causing guttation and infiltration, followed in a few hours by necrosis. The fungus then at once enters the dead tissue from the outside through the stomata and produces acervuli in the substomatal air chambers on both sides of the leaf. The spot may enlarge until the process becomes arrested by a margin of tissue impregnated with gum. After a week or longer the spots collapse, and in them only the acervuli on the upper side of the leaf continue to produce conidia. Between the acervuli a *Leptosphaeria* [ibid., xii, p. 458] with its *Hendersonia* stage is regularly present, the dry centres also always showing minute perithecia of a *Mycosphaerella* [ibid., xv, p. 164] and spermogonia shown to belong to *Cercospora*, which is probably the imperfect stage of the *Mycosphaerella*.

In Surinam (where two or three applications of Bordeaux mixture each year since 1934 have been given with good results) outbreaks occur in February and July, each resulting from infection accumulated four or five weeks before. The lower surface of the first two or three leaves should therefore be sprayed in December or January and May or June. In badly infected fields the older spotted leaves should be stripped off, and the spraying repeated after 15 to 20 days.

Salgues (R.). **Affections parasitaires des Olives et modifications physico-chimiques de l'huile extraite.** [Parasitic diseases of Olives and physico-chemical modifications of the extracted oil.]—*C.R. Soc. Biol., Paris*, cxxiv, 9, pp. 817–819, 1937.

Macrophoma dalmatica, the agent of a light brown, circular, crateriform, relatively inconspicuous spotting of olives in the south of France, Spain, Italy, Austria, [and Cyprus: *R.A.M.*, xiv, p. 83] has been observed on several French varieties, including Pigale, Olivière, Amellau, Moirale, and Caillet, the writer's studies at Brignoles (Var) being mainly concerned with the last-named. The disease has been shown to result not only in a diminution of 3·18 per cent. in the oil content but also in an undesirable dryness of the extract as compared with that obtained from healthy fruits.

Ferraris (T.). **La lotta contro le malattie dell' Olivo.** [The control of Olive diseases.]—*Riv. agric., Roma*, xxxiii, 752, p. 91, 1937.

Olives in Italy are liable to attack by numerous diseases, including *Bacillus* [*Pseudomonas*] *savastanoi* [*R.A.M.*, xiv, p. 706], *Stictis panizzei* [ibid., iii, p. 348; iv, p. 358], *Cycloconium oleaginum* [ibid., xiv, p. 706], *Cylindrosporium oliviae*, *Fomes fulvus* [ibid., vii, p. 12], *Antennaria elaeophila* [*Capnodium elaeophilum*: ibid., vii, p. 187], and

Sphaeropsis dalmatica [ibid., xv, p. 774]. For the combined control of diseases and insect pests the author recommends a dormant application of a mixture of 3 kg. copper sulphate, 2 kg. iron sulphate, 5 kg. slaked lime, and 1·5 kg. each of carbolineum and sodium hydrate per 100 l. water, followed by other applications when the shoots are young, after flowering, and just before fruit ripening of a mixture of 0·5 kg. copper sulphate, 0·5 kg. ferrous sulphate, 1 kg. slaked lime, 1·5 kg. potassium soft soap, and 0·2 kg. nicotine sulphate per 100 l. water.

BALLOU (F. H.). **Stationary equipment for orchard spraying and the manufacture of home-made liquid lime-sulphur.**—*Bull. Ohio agric. Expt Sta.* 572, 26 pp., 7 figs., 1936. [Received May, 1937.]

After discussing the advantages and disadvantages of stationary spraying for orchards [*R.A.M.*, xvi, p. 389], the author gives a full description of a powerful spraying unit set up in a hilly district of central Ohio in 1929. Water is utilized from a neighbouring spring, from the roof drainage of buildings in the vicinity, and in the dry season, from a large pond. The power pump used has a capacity of 20 galls. per minute at a pressure of 500 lb. Three lines of hose are employed, requiring three men, and ample pressure is provided for all three lines, even on high hilltops a quarter of a mile away, a satisfactory overflow of solution through the pressure relief valve back into the spray tank (1,000 galls. capacity) being maintained. The tank is divided into two equal compartments, spraying being carried out from one while the other is being filled. The main pipe line is 1¼ in. in diameter and about 2,000 ft. long, the lateral pipes being ¾ in. in diameter, and 175 to 200 ft. (five tree rows) apart. All valves are of the gate type and quickly attachable hose connexions are fitted to the side openings of the T pipe couplings at intervals of 100 to 120 ft., so that by using 100 ft. lengths of spray hose all the trees in a 20-tree block can easily be reached. Instructions are given for the care of the pipe system and putting the machinery into operation, and the paper concludes with full directions for the preparation of home-made liquid lime-sulphur.

TURNBULL (J.). **Fruit tree spraying in 1936.**—*J. Minist. Agric.*, xliii, 12, pp. 1145–1157, 1937.

Analysis of the cost of apple spraying with the latest apparatus showed that including spray mixture, labour, and plant it amounted (per acre) to £6 5*s.* 2*d.*, for average-sized bush trees, using a central plant; £5 18*s.* 8*d.*, for average half standard, using a portable plant; and £8 13*s.* 3*d.*, for very large trees, using a central plant and a heavy programme. In a preliminary test with a new American mobile outfit (from which two men spray while riding on the machine) the figure was only £4 7*s.* 5*d.*, owing to the small amount of wash used. The capital cost per acre amounts to about £12 for a central plant with underground pipes [cf. preceding abstract], and £6 to £8 for the portable and American systems, the latter figure not including the cost of laying on water (often about £2 per acre) or that of the tractor required by the American machine. While the mobile system is excellent in young plantations where the trees are widely separated, and in old ones where they are very tall, in profitable orchards and plantations of bearing

trees the extra expense involved in laying down underground pipes is more than compensated for by the great simplicity of working [cf. *R.A.M.*, xv, p. 380]. Exact figures for the American system, the chief drawback to which is the time wasted in filling, are not yet available.

Vergleichsprüfung von Karrenspritzen für Schädlingsbekämpfung. [A comparative trial of truck sprayers for pest control.]—*Masch. u. Geräteprüf. Reichsnährstandes* (Suppl. to *Tech. in d. Landw.*), ii, 3, pp. 13–20, 5 figs., 16 diags., 4 graphs, 1937.

Full technical details are given of the construction and application of four spraying appliances awarded the silver medal (first prize) of the Reich Food Board at Frankfurt-am-Main in 1936 [cf. *R.A.M.*, xvi, p. 265], viz., 'Suevia' (Gebr. Holder, Metzingen, Württemberg, price R.M. 85 as a mounted pump, 164.25 as a two-wheeled truck), 'Alemannia' (C. Platz, Ludwigshafen, Rhein, R.M. 95 and 160.50, respectively), 'Maxim 2' (Bucher & Guyer, Griessen in Baden, both R.M. 106.50), and 'Rex' (F. Burr, Maschinenbau Degernau, now under the management of F. F. A. Schulze, Berlin, available as a mounted pump only, R.M. 48).

Gebers (A.). **Ein selbstgebauter Erddämpfungskessel.** [A home-constructed soil-steaming kettle.]—*Blumen- u. PflBau ver. Gartenwelt*, xli, 11, p. 116, 1 fig., 1937.

For soil sterilization on a small scale by steaming [*R.A.M.*, xvi, p. 124] the writer uses a large washing-copper, into which a sheet of iron is inserted in such a way as to accommodate some 25 l. water below and about 150 l. soil above it. When the copper is heated the water evaporates through the soil, the process of sterilization being complete when a potato placed in the soil becomes soft.

v. d. Muyzenberg (E. W. B.) & Roghair van Rijn (J. J. F.). **De grondontsmetting door middel van electriciteit.** [Soil disinfection by means of electricity.]—*Meded. Land Hoogesch. Wageningen*, xl, 4, 75 pp., 3 pl., 10 graphs, 1936. [English summary. Received April, 1937.]

This is a comprehensive, tabulated account, amplified by citations from the relevant contemporary literature, of the writer's experiments in the application under Dutch conditions of certain American methods of soil pasteurization by means of electricity [*R.A.M.*, xvi, p. 204]. In experiments on the factors affecting conductivity it was found that conductivity increased proportionally to the moisture content with slight deviation when this is low. When the water content of the soil is about 10 per cent., the strength of the current may be increased by the addition of fertilizers, such as ammonium nitrate or potassium sulphate. The relation between temperature and conductivity of the soil is expressed by the formula $I_t/I_{100} = \beta(100\text{-}t)$, in which $\beta = 0{\cdot}0073$, t = temperature in °C., and I = strength of the current in ampères. Experimental data indicated that from 0·06 to 0·15 kilowatt hours of electricity are consumed per cu. dcm. of soil raising the temperature from between 4° and 24° up to 100° depending upon moisture content,

maximum strength of the current, initial temperature, and the like. This method of sterilization is specially recommended for the treatment of small quantities of soil.

MARSH (R. W.). **Some American work on the copper fungicides.**—*Sci. Hort.* (formerly *H.E.A. Yearb.*), v, pp. 60–66, 1937.

From a review of recent modifications of, and substitutes for, Bordeaux mixture [*R.A.M.*, xvi, p. 332] and the use of cuprous oxide [ibid., xv, p. 551 and above, p. 544] as a seed dressing the author concludes that in the absence of blight [*Phytophthora infestans*] potatoes sprayed with Bordeaux mixture give the highest yields when the successive applications contain decreasing amounts of copper. For this crop the lime content of the mixture should not be more than half the copper sulphate content. Copper phosphate and copper ammonium silicate (coposil) [ibid., xvi, p. 477] give promise as fungicides on apples, but may cause injury. On tomato, rose, and hop leaves and flowers cuprous oxide is less injurious than Bordeaux mixture. Cuprous oxide powder as a seed dressing shows marked possibilities for the control of damping-off [*Pythium de Baryanum* and other fungi] and seedling rots. A bibliography of 35 titles is appended.

LA RUE (C. D.). **The use of bromine in the sterilization of fruits and seeds.**—*Science*, N.S., lxxxv, 2204, p. 319, 1937.

In raising sterile seedlings highly satisfactory results were obtained by disinfecting the seed with bromine water diluted 1 in 10, the liquid being poured over the seeds in a container, which was then tightly stoppered. Oats were injured by exposures of over half-an-hour, but maize, cabbage, radish, and sunflower withstood over one hour's immersion. Fruits, from which embryos were later removed for culture purposes, were similarly treated with success, the method considerably increasing the likelihood of obtaining sterile embryos. Immature ovules from tomato were treated for half an hour without ill effect to the young embryos. Fragments of stems and roots, similarly treated, were grown in sterile culture, as were even leaves and flower buds. No rinsing is required after treatment, the structures being placed on sterile filter paper, in liquid, or on agar.

CHEW (A. P.). **Science serving agriculture.**—44 pp., 23 figs., U.S. Dep. Agric., 1936.

In this manual, prepared in 1933, and slightly revised and reissued for distribution at the California Pacific International Exposition in 1936, the writer selects some telling instances of the application of modern scientific principles to practical agriculture, including a number of phytopathological interest. Among these may be cited the control of sugar-cane mosaic in Louisiana [*R.A.M.*, xvi, p. 276], chiefly by means of resistant varieties, the introduction of which restored the yield from less than 50,000 to more than 200,000 tons per annum.

Important progress has been made in the development of sugar-beets resistant to curly top [ibid., xvi, p. 433] and of lettuce varieties capable of withstanding the ravages of brown blight [ibid., viii, p. 286]. In

connexion with the latter it is stated that I. C. Jagger's Imperial Nos. 2, 3, and 6 (strains of New York), while practically immune from brown blight, are highly susceptible to mildew [*Bremia lactucae*: ibid., xiv, p. 683], and it was therefore necessary to breed some so-called 'double resistant' types. This was effected by crossing the mildew-susceptible New York with the highly resistant French Cos or Romaine varieties, and by crossing selections of the resultant progeny with brown blight-resistant Imperial 2 and 3, leading ultimately to the development of the 'double-resistant' Imperial C, D, and F.

HANSFORD (C. G.). **Annotated host list of Uganda parasitic fungi and plant diseases.—Part I.**—*E. Afr. agric. J.*, ii, 5, pp. 419–424, 1937.

This first instalment of the author's list of parasitic fungi and plant diseases so far recorded in Uganda covers hosts belonging to 29 families. Many new fungal species are listed, for which Latin diagnoses are promised shortly. Notes are added on pathological aspects of the more important fungi.

TERRY (M. C.). **To keep culture-media from drying-out.**—*Science*, N.S., lxxxv, 2204, pp. 319–320, 1937.

The author has found 'parafilm' (made by the Marathon Paper Mills Co., Rothschild, Wisconsin) very useful for sealing culture tubes and Petri dishes to prevent the media drying out. It has the advantage over wax of being readily stripped off. Poured plates sealed in this manner are stacked in storage with waxed paper between to prevent sticking.

RYZHKOV [RYJKOFF] (V. L.). Иммунитет растений к болезням, вызываемым фильтрующимся вирусом. [Immunity of plants from diseases caused by filterable viruses.]—*Bull. appl. Bot. Select., 1937*, Ser. II, 11, pp. 81–105, 1937. [English summary.]

In this survey the author gives a list of the more important and best studied plant viruses with the reactions of 24 host plants to them, and then briefly reviews the work done in the investigation of inter- and intraspecific immunity of various plants from the viruses, the resistance of individual plants within species or varieties, and acquired immunity. A bibliography of 70 titles is appended.

PUTNAM (D. F.). **Comparative studies in Potato virus diseases.**—*Canad. J. Res.*, xv, 3, pp. 87–107, 3 pl., 1937.

Inspection of President potatoes grown in Nova Scotia by the Canadian Potato Certification service showed the presence in a mild and severe form of a hitherto undescribed mosaic disease, termed 'yellow mottle'.

Comparative studies between common mottle virus, the ring spot virus (seldom found pure in potatoes), and yellow mottle (apparently often uncontaminated in President potatoes) showed that the three viruses belong to the same group. They were all able to infect *Datura stramonium*, were not transmissible by *Myzus persicae*, and were equally resistant to inactivation by various chemicals, while as regards longevity the yellow mottle virus retained its infectivity *in vitro* for over two

months, in this respect comparing favourably with the other two. The rate of movement of the yellow mottle virus through tomato tissues was less than that for ring spot but greater than that for mottle. The higher thermal death point of yellow mottle (73° C. for 10 minutes) separated it from mottle (70°) and ring spot (68°); it was still infective after heating to 72°, and caused no symptoms in *D. stramonium* attributable to admixture with other strains. Evidence was obtained that mottle and yellow mottle may occur together on the same plant.

Brief descriptions are given of the viruses themselves and their symptoms on eight different hosts. Yellow mottle is stated to be easily transmissible mechanically by plant extract and grafting, readily filterable through Mandler N and Berkfeld W candles, filterable with difficulty through Seitz E K size 3 disks, and best characterized in symptoms by its strikingly yellow mottling on tomato, in which there are bright yellow interveinal areas and very dark green bands of tissue along the veins.

The data obtained conclusively demonstrated that a single virus entity causes, unassisted, a specific mosaic disease of President potatoes. All three viruses infected the same hosts and no host plant was found to retain any one exclusively; they could be separated from veinbanding by passage through *D. stramonium*, and in combination with other viruses such as the veinbanding virus or tobacco virus 1 they caused similar symptoms on a number of hosts, e.g., spot necrosis on *Nicotiana alata* and streak on tomato. The author's yellow mottle virus of President potato mosaic is therefore regarded as a further member of the 'latent' or 'X-virus' group.

WHITEHEAD (T.). **The virus problem in relation to seed Potato production in North Wales.**—*Sci. Hort.* (formerly *H.E.A. Yearb.*), v, pp. 39–46, 1937.

The scheme begun in 1927 in North Wales for the production of high quality potato seed tubers [*R.A.M.*, xiii, p. 236] has proved highly successful and has been much expanded, some 70 growers now producing upwards of 250 tons of 'seed' per annum. The great majority of the farms have under 1 per cent. disease. The great success met with is partly due to the pastoral character of the country, which has facilitated the isolation and inspection of the small acreages of potatoes grown on each farm.

Work by W. M. Davies showed that *Myzus persicae* winters in a wingless form on species of *Brassica*, and this to some extent explains why the farms situated in the east of Wales have been less successful than those on the coast, since in the eastern market-garden areas many insects reach the potato crops from the *Brassicae* and would be likely to contract infection from diseased potatoes. There was no evidence that species of *Brassica* themselves act as sources of disease. The infection of a potato crop by virus diseases depends chiefly on the number of diseased plants in the vicinity, and the rate of subsequent movement of the insects in the crop. Even the wingless forms move about with ease, and account for much transmission. That aphids take to flight only in a dry, still atmosphere is a further reason why the farms in the humid, windy coastal regions of Anglesey and south Carnarvonshire

are the most successful in raising disease-free potatoes. It was also found that the time of the first migration to potatoes and the rate of breeding differ with the species, and that the aphid responsible for most of the spread of potato virus disease [*M. persicae*] reaches its maximum infestation on potatoes later in the west than in the east of Wales, and occurs when the crop is ripening off.

By the Seeds (Amendment) Regulations of 1935, the Welsh certified seed can now be sold as Class I (Welsh special stocks), grown under a scheme approved by the Ministry of Agriculture. Such seed must be raised in a district known to permit only minimal spread of virus diseases from a crop showing less than 3 per cent. of virus disease, and the grower is prohibited from planting on his own land any seed from a crop showing more than 1 per cent. visible virus disease.

Beaucarnot (R.). **Rendements et résistance à la dégénérescence de quelques variétés de Pommes de terre.** [Yields and resistance to degeneration of some Potato varieties.]—*Agric. prat., Paris*, N.S., ci, 13, pp. 429–430, 1937.

Continuing his studies on productivity and reaction to 'degeneration' in a number of potato varieties resistant to wart disease [*Synchytrium endobioticum*] [*R.A.M.*, xv, p. 822], the writer obtained satisfactory results with two of Dutch origin, Bevelander and Alpha, which combined prolific yields (103 and 32 per cent., respectively, in excess of those given by the standard local variety, Institut de Beauvais), with a low incidence of disease (0 and 2 per cent., respectively). Arran Banner and Kerr's Pink, the former a heavy yielder and approximating in general type to Institut de Beauvais, also merit further consideration.

Dumon (A.) & Manil (P.). **L'influence des conditions de milieu sur la valeur culturale des plants de Pommes de terre, et notamment sur leur état sanitaire, d'après les travaux récents.** [The influence of environmental conditions on the cultural value of seed Potatoes, especially in respect of their state of health, in the light of recent studies.]—*Bull. Inst. agron. Gembloux*, vi, 1, pp. 33–52, 3 graphs, 1937. [Flemish, German, and English summaries.]

Most of the work here summarized on the influence of environmental conditions on potato degeneration (in relation to virus diseases) in Europe [*R.A.M.*, xvi, p. 486] has been noticed in this *Review* from the original sources.

Botjes (J. G. O.). **De oorzaak van het optreden van dwergmozaiekzieke Aardappelplanten (stekelkoppen).** [The cause of the occurrence of dwarf mosaic-diseased Potato plants ('spring heads').]—*Tijdschr. PlZiekt.*, xliii, 3, pp. 60–63, 1 col. pl., 1937. [English summary.]

During the last 15 years Eigenheimer potatoes at Oostwold have been observed to suffer both from ordinary and mild mosaic [*R.A.M.*, xvi, p. 487], and grafting experiments showed that plants affected by the latter disease also contain the stipple streak (acropetal necrosis)

virus [ibid., xvi, p. 402] in a masked form. In the course of annual field counts of mosaic plants, certain individuals presenting distinctly atypical symptoms have consistently been noticed. Such plants are conspicuous by their stunted, dwarfed stature and by the clustering of the undulating leaves, especially near the tops of the abnormally short stems. Among farmers in north-east Holland the disorder, which has long been prevalent, is known as 'spring heads', and there seems to be little doubt that it is identical with curly dwarf [ibid., xvi, p. 270] and 'bukett' disease [ibid., viii, p. 593; x, p. 264]. Tubers from dwarfed plants gave rise to progeny of a similar growth habit, while those from mosaic plants yielded a predominantly mosaic stand with a sprinkling of dwarfed individuals. It was conclusively shown by grafting experiments that curly dwarf arises from a combination of the viruses of ordinary mosaic and stipple streak, the absence of mild mosaic as a component being clear from the success of tests with Pale Red Star, which harbours stipple streak but not mild mosaic.

Kameraz (A. J.) & Anikieff (A. M.). Исследование депрессии Картофеля по методу Беххольда и Эрбе. [Investigation of degeneration in the Potato by Bechhold and Erbe's method.]—*Bull. appl. Bot. Select., 1937*, Ser. II, 11, pp. 201–214, 1937. [English summary.]

Details are given of one year's tests, carried out by Bechhold and Erbe's copper strip method [*R.A.M.*, xvi, p. 337 *et passim*], to determine the freedom from degeneration [virus] diseases of the potato material brought to the U.S.S.R. from Central and South America [see next abstract], as well as that of 37 hybrids between these wild and cultivated species and European potato varieties. In almost every case the reaction of the tubers tested to the copper strip was in keeping with their behaviour in the field. The results of similar tests with half-tubers of 481 commercial varieties, the other halves being planted in the field, indicated, however, that the method is not altogether accurate, as apart from the health of the tubers tested, variations in the intensity of reaction also appeared to depend on the variety, the origin of the tubers, and various environmental factors. While the data obtained are inadequate as a basis for definite conclusions, the authors are inclined to agree with Klinkowski [ibid., xv, p. 171] that, until further developed, the method may only be useful in the preliminary determination of the extremes in the state of health of potato planting material.

Sidoroff (F. F.). Селекция Картофеля на иммунитет к **Phytophthora infestans DB.** [The breeding of Potatoes for immunity from *Phytophthora infestans* de Bary.]—*Bull. appl. Bot. Select., 1937*, Ser. II, 11, pp. 5–76, 12 figs., 1 map, 1937. [English summary.]

After giving a general review of the previous and contemporary work done abroad in the attempt to produce potato varieties resistant to late blight (*Phytophthora infestans*), the author describes and discusses at some length the results obtained so far in the U.S.S.R. in similar work carried out with the rich collection, comprising 133 species and

forms of wild, semi-wild, and cultivated species [which are listed] of potato brought back by Russian scientists from South and Central America, and over 70 European cultivated varieties. Artificial inoculation tests in the greenhouse showed that *Solanum andigenum*, a polymorphous cultivated endemic species contains the greatest number of forms resistant to *P. infestans*, most of these occurring in Colombia and Mexico, Bolivia, South and Central Peru coming next in this respect. Forms of *S. tuberosum* from Chile are, as a general rule, more susceptible than varieties grown in temperate latitudes. All the rest of the new cultivated species, which are united under the term 'primitive', were highly susceptible to artificial infection. Although no cultivated varieties or forms were found entirely immune, an increase of resistance was observed in some, either as a result of cumulative breeding, or of mutation. Among the wild potatoes, nine species, namely, *S. demissum*, *S. semidemissum*, *S. verrucosum*, *S. antipoviczii*, *S. ajuscoense*, *S. vallis mexici*, *S. polyadenium*, *S. coyoacanum*, and *S. bulbocastanum*, were found to be immune as a rule from *P. infestans* [but cf. *R.A.M.*, xvi, p. 403], even when artificially inoculated, although in isolated cases (in *S. verrucosum*, *S. ajuscoense*, and some varieties of *S. antipoviczii*) the inoculated plants developed small patches which did not develop further. The immune wild species are all native in Mexico whence most of the resistant cultivated species also originate, and these facts suggest that the development of forms and species is influenced by environmental conditions.

Tests of hybrids produced in the U.S.S.R. showed that although many strains highly resistant to *P. infestans* and possessed of other valuable commercial properties could be observed in the F_1 of *S. andigenum* × *S. tuberosum* crosses, there is little probability of obtaining entirely immune varieties in this way, in view of the important part played by the *S. tuberosum* parent in such crosses. Back-crossing F_1 *S. demissum* × *S. tuberosum* hybrids with *S. tuberosum* in recent years gave very good results in several localities, since it gave forms combining high productivity, equalling that of the *S. tuberosum* parent, with immunity from *P. infestans* in the field; these forms, however, exhibited some undesirable characters, such as poor shape and unpalatability of the tubers, but it is believed that further back-crossing may yield in the third or fourth generation a new acceptable potato variety immune from the disease. Crossing between *S. antipoviczii* and *S. tuberosum* produced hybrids characterized by high productivity and high starch content, but of a low degree of frost resistance and high susceptibility to virus diseases, this limiting their usefulness for breeding purposes.

The possibilities offered by the wild potato species in breeding work do not yet appear to be exhausted; a new direction to further research is suggested by the fact that Mme M. S. Blagovidova, by crossing *S. acaule* with the potato variety Fürstenkrone, both of which are susceptible to *P. infestans*, obtained an immune hybrid, indicating that interspecific hybrids of susceptible parents should also be tested for their reaction to late blight.

[A somewhat condensed account of this work is given by the author in German in *Phytopathology*, xxvii, 3, pp. 211–241, 1 diag., 1937.]

KARGAPOLOVA (Mme N. N.). Анатомические особенности различных по устойчивости к **Phytophthora infestans DB.** сортов и видов Картофеля. [Anatomical peculiarities of varieties and species of the Potato, differing in their resistance to *Phytophthora infestans* de Bary.]—*Bull. appl. Bot. Select., 1937*, Ser. II, 11, pp. 215–226, 12 figs., 1937. [English summary.]

From a review of the relevant literature and also from her own anatomical studies of a number of potato species and varieties, ranging in reaction to *Phytophthora infestans* [see preceding abstract] from high susceptibility in *Solanum leptostigma* and *S. aracc-papa* to high resistance in *S. neoantipoviczii* and *S. demissum*, the author concludes that no definite correlation can be established between susceptibility and anatomical structure.

SMALL (T.). **The control of Potato blight in Jersey.**—*J. Minist. Agric.*, xliii, 12, pp. 1162–1168, 2 pl., 1937.

In this account of the progress made in the control of potato blight (*Phytophthora infestans*) in Jersey [see above, p. 514] the author recommends spraying with Bordeaux or Burgundy mixture at fortnightly intervals beginning when the plants are 8 to 10 in. high. When a good yield of tubers has formed, the haulms should be scorched or cut while the crop is healthy, or at the latest when the disease appears, and the crop may be dug immediately afterwards. Diseased crops should be scorched, not cut, and at least one week allowed to elapse before digging in dry weather and longer in wet weather. When one-half of a 5½ acre field was sprayed twice with Bordeaux mixture, dusted once, and finally scorched with sulphuric acid the treatment effected an estimated saving of £100 through the increased yield of clean tubers. Where infection is prevalent but recent, blight development in the seed tubers after digging may be minimized by immersing them in formalin (1 part of 40 per cent. in 99 of water). In trials conducted in 1935 and 1936 this treatment gave 1,706 healthy and only 48 diseased tubers as against 2,512 healthy and 2,109 diseased for the untreated controls. In one experiment potatoes dug before scorching and undipped, scorched six days before digging and undipped, the same dipped, and not scorched or dipped gave, respectively, 232, 480, 126, and 309 healthy, and 404, 130, 1, and 264 diseased tubers in storage.

NATTRASS (R. M.). **Preliminary trial of disinfection of seed Potatoes to control scab.**—*Cyprus agric. J.*, xxxii, 1, p. 23, 1937.

The potato scab organism (*Actinomyces scabies*) does not appear to be normally present in Cyprus soils but has been introduced with imported seed and occasionally appears on the spring crop. In experiments on control, good commercial seed of the Up-to-Date variety treated with an organic mercury compound before export from Ireland yielded on planting in Cyprus 0·0 per cent. scabbed tubers (2 tubers in 300 lb.), compared with 8·6 per cent. for untreated seed. Corresponding figures for severely infected seed tubers of the same variety were 0·78 and 19·8 per cent. respectively. Owing to wet weather at the time of dispatch the treated seed on arrival in Cyprus was slightly moist and showed about 50 per cent. more wastage than the untreated.

DAINES (R. H.). **Antagonistic action of Trichoderma on Actinomyces scabies and Rhizoctonia solani.**—*Amer. Potato J.*, xiv, 3, pp. 85–93, 1937.

Trichoderma lignorum was found to produce a diffusible substance toxic to *Actinomyces scabies* [*R.A.M.*, xvi, p. 408] in a synthetic medium consisting of dextrose broth plus either 5 gm. bactopeptone per l. or horse manure infusion. The principle, however, is rapidly destroyed by aeration at the hydrogen-ion concentrations (P_H 5·1 to 5·8) of New Jersey potato soils, besides being removed from solution by charcoal and by the soil itself, so that its practical utility in combating scab is somewhat problematical. It was further ascertained that the introduction of *T. lignorum* into a five-day-old culture of *A. scabies* results in the inhibition of the former, while a soil-inhabiting bacterium produces a substance equally toxic alike to both fungi. In such complex physical, chemical, and biological environments as are afforded by soils, antagonistic relationships like the one herein described are obviously liable to modification or even destruction. No significant improvement in the condition of potato stems infected by *Rhizoctonia* [*Corticium*] *solani* was effected by immersion in a spore suspension of *T. lignorum* [ibid., xvi, p. 268].

DARLING (H. M.). **A study of scab resistance in the Potato.**—*J. agric. Res.*, liv, 4, pp. 305–317, 7 figs., 1937.

A summarized account is given of experiments from 1931 to 1934, inclusive, at two centres in Minnesota, in which the resistance of a number of inbred and hybrid potato seedlings to common scab (*Actinomyces scabies*) [*R.A.M.*, xvi, p. 273] was tested in scab-infected soil. The results indicated that resistance to scab is apparently relative, since complete immunity was not observed. The fact that resistant seedlings were found in the progeny of susceptible parents suggested that although most commercial varieties of the potato are susceptible, they may contain factors for resistance, and that, by selfing, plants having these factors may be isolated in a relatively homozygous condition, a view which was confirmed by the inheritance in the tests of resistance in a very high percentage of the progeny of the resistant seedling 5–10–1. Certain susceptible seedlings produced both susceptible and resistant progeny. No consistent relation was determined between scab resistance and the russet type of skin in the tubers, and no difference was found between the stomata of resistant and susceptible seedlings. The lenticels, however, which appear to be the chief point of infection, were larger in the susceptible than in the resistant seedlings; they were also rounder and more loosely arranged in the former, thus offering a better infection court. In the resistant seedlings the periderm of the tuber was suberized earlier than in the susceptible, and the suberization extended farther into the lenticels, apparently affording greater protection against infection of the meristematic tissues. The results of these studies encourage the belief that potato varieties may eventually be produced, combining both scab resistance and desirable commercial qualities.

YOSHII (H.). **Pathological studies on Rice blast, caused by Piricularia oryzae. III. Patho-histological observations of diseased plants.**—*Ann. phytopath. Soc. Japan*, vi, 4, pp. 289–304, 7 figs., 1937. [Japanese, with English summary.]

The diseased portions of rice leaves attacked by blast (*Piricularia oryzae*) [*R.A.M.*, xvi, p. 406] may be divided into three zones—venenate, necrotic, and disintegrated: the first occupying the border of the infected area, often showing a long, pale yellowish stripe and blending gradually into the healthy tissue; the second forming a narrow brown streak along the inner side of the venenate zone or along the vascular bundles within the affected part; while the third and largest zone is greyish-brown and somewhat desiccated. The histopathological changes occurring in the venenate zone, which develops as a result of infiltration by a toxic excretion of the fungus, include discoloration and shrinking of the chloroplasts, degeneration of the cell membrane, and vacuolar or granular disintegration of the protoplasm. The disintegrated zone is formed by the active spread of the hyphae in the tissues of the venenate zone, causing collapse of the cell inclusions and cell walls, a transitional stage of less intensive infection being constituted by the intervening necrotic zone. In general, the pathological modifications of infected nodes of racheae, ear bases, and flag leaves resemble those described for the foliage. The decrease of starch in the affected tissues may be attributed to the conversion of reserve starch into sugar, while its irregular distribution is probably correlated with the feeble diastatic action of the fungus.

SHIMADA (S.). **Studies on the wound infection of the Rice plant by Piricularia oryzae.**—*Ann. phytopath. Soc. Japan*, vi, 4, pp. 307–318, 1937. [Japanese, with English summary.]

Rice leaves wounded by various methods invariably developed more lesions in response to inoculation with a conidial suspension of *Piricularia oryzae* [see preceding abstract] than uninjured ones, the effects being more noticeable under conditions of poor nutrition and when the plants were vigorously shaken before infection. The cuticular layer of the leaf mould thus appears to contribute materially to the resistance of rice to the blast disease.

HARMSEN (J. R.). **Bruine binnenbastziekte.** [Brown bast disease.]—*Bergcultures*, xi, 11, pp. 351–355, 2 figs., 1937.

This is a critical survey of some outstanding contributions to the knowledge of brown bast of *Hevea* rubber, with special reference to their bearing on the etiology and control of the disease in the Dutch East Indies [*R.A.M.*, xvi, p. 340]. Severe attacks of the disorder are stated to be now exceptional as a result of conservative tapping methods, and it is seldom that therapeutic measures are required. The writer's method of control by curtailing the tapping cut was successfully applied in 1921–2 and again in 1930–4, especially in young, vigorous plantations.

NIETHAMMER (ANNELIESE). **Die mikroskopischen Bodenpilze.** [The microscopic soil fungi.]—*Tabul. biol., Berl.*, vi, 3, pp. 279–284, 1937.

The writer presents in tabular form the data resulting from her

studies on soil fungi, some of which have already been noticed from another source [*R.A.M.*, xiv, p. 655]. Attention is drawn to the great utility of Mme Kubiena's method of direct microscopic examination of soil organisms [ibid., xiv, p. 392]. The distribution of the latter is considered from the geographical, pedological, and botanical standpoints. Generally speaking, the Mucorineae prefer temperate climates and soils of a China clay or ashen consistency, species of *Penicillium* predominate in the brown Central European soils, while the Aspergillaceae are at home in the subtropical red-brown or tropical black soils. Mucorineae, especially *Mucor ramannianus*, are prevalent in coniferous forests [ibid., xiv, p. 655; xv, p. 520], while *Penicillium* spp. and (in subtropical regions) *Monilia* spp. abound among hardwoods. Orchard soils are mostly occupied by species with a certain affinity for fruits, such as *Mucor racemosus*, *P. expansum* [ibid., xvi, p. 189], *Botrytis cinerea*, and *Dematium* [*Pullularia*] *pullulans*, and the same applies to vineyards. Meadow soils contain chiefly *Zygorrhynchus moelleri* [ibid., xiv, p. 655; cf. also xvi, p. 407] and *Cladosporium herbarum*, together with numerous species of *Fusarium*. Soil fungi, mainly *M. hiemalis* [ibid., xiv, p. 655], *M. flavus*, *Penicillium notatum* [ibid., xiii, p. 572], *C. herbarum*, and *F.* spp., occur in profusion in virgin soil, wayside paths, stony slopes, and the like, while arable land is poorer in these organisms, which are principally represented by *M. racemosus*, *P. crustosum*, *P. expansum*, *C. herbarum*, and *F.* spp. *Trichoderma koningi* [see below, p. 575], *P. solitum*, and *Z. moelleri* are found in moorland soils. *Rhizopus nigricans* is present in marked profusion under sugar beets [ibid., xv, p. 765], while kitchen-garden soils are occupied by a great variety of fungi. *T. koningi* and other fungi exert a certain chemotherapeutic action on various plant parasites, e.g., *Rhizoctonia*, *Phytophthora*, and *Phoma* spp. [cf. ibid., xvi, p. 408], while *Rhizopus* and *Aspergillus* spp. secrete growth-promoting substances [ibid., xv, p. 110]. The Mucorineae are chiefly concerned in the disintegration of nitrogenous and albumin compounds, while cellulose is destroyed by species of *Aspergillus*, *Penicillium*, *Botrytis*, *Monilia*, and *Trichoderma*, the last-named also utilizing nitrogen.

Singh (J.). **Soil fungi and actinomycetes in relation to manurial treatment, season, and crop.**—*Ann. appl. Biol.*, xxiv, 1, pp. 154–168, 2 pl., 6 graphs, 1937.

The examination in 1931–2 of soil samples taken from two fields in Rothamsted, one of which had been permanently kept under wheat since 1843 and the other under root crops since 1856 (mangolds since 1876) (the two had received differential manures throughout), established a direct correlation between soil fertility, as measured by the yield of the crops, and the number of soil fungi and actinomycetes contained in them. Only inconclusive or negative evidence, however, was obtained with regard to the periodicity of the organisms, though there was a tendency for the numbers throughout the year to fluctuate about a mean value, with an indication of lower numbers in the winter [*R.A.M.*, vii, p. 740 *et passim*]. While the nature of the crop did not appear to have a marked effect on the numbers of the micro-organisms studied, there was a suggestion that actinomycetes were more numerous

under wheat and fungi under the mangolds. No support was found for the view that particular manurial treatments favour the development of specific soil fungal floras, but higher fertility was directly correlated with a greater variety of soil fungi. Species of *Penicillium* and forms of *Dematium* were more prevalent in the mangold field, and *Fusarium* spp. tended to predominate under the wheat; *Monilia* spp. were fairly uniformly distributed in the two fields, but *Aspergillus* and *Mucor* were scarce.

MULLER (H. R. A.). **Het Phytophthora-voetrot van Peper (Piper nigrum L.) in Nederlandsche-Indië.** [The *Phytophthora* foot rot of pepper (*Piper nigrum* L.) in the Dutch East Indies.]—*Meded. Inst. PlZiekt., Batavia*, 88, 73 pp., 6 pl., 2 diags., 1 map, 1936. [English summary. Received March, 1937.]

Since 1928 foot rot of pepper (*Piper nigrum*) has assumed major importance in most of the cultivation centres in Sumatra, Java, and Borneo [*R.A.M.*, xiv, p. 152] and has recently been observed on the island of Bangka. In some districts the ravages of the disease have necessitated the abandonment of the crop.

Infection usually begins on the stems at a height of up to 30 cm. from the base; on non-suberized stems the diseased cortex rapidly turns from dark watery green to black, but no external symptoms are apparent on cork-covered bark. The soft parenchymatous tissues of the cortex and medullary rays quickly decay, while the xylem remains intact apart from a slight brownish discoloration. The affected bark often peels off and the central cylinder splits into a bundle of loose xylem vessels due to the rotting of the connecting tissues. The leaves turn yellow, wilt, and drop, or in dry, hot weather they may blacken and adhere to the plants. Most of the roots of wilting plants are still normal but foot rot symptoms begin at the base and progress towards the root tips. During the period of active spread of the disease somewhat inconspicuous, greyish-brown spots up to 5 cm. in diameter, are formed near the tips and margins of the lower leaves; the lesions are surrounded by a zone, 3 to 5 mm. in width, of watery, dark green tissue, from the under side of which drops of a yellowish fluid are exuded.

Inoculation experiments on pepper plants with six cultures of a *Phytophthora* isolated from diseased material gave positive results, whereas nine strains from other hosts failed to cause infection. The pepper *Phytophthora* was shown to be capable of infecting papaw, cacao, rubber (*Hevea brasiliensis*), *Ricinus communis*, eggplant, tobacco, *Phalaenopsis amabilis*, and *Colocasia antiquorum*, but the symptoms it induced were in general less virulent than those caused by the species proper to these hosts viz., *P. palmivora* in the case of the three first-named [ibid., xv, p. 345], *P. parasitica* from *R. communis* [ibid., xv, p. 378] and eggplant, *P. parasitica* var. *nicotianae* from tobacco [ibid., xvi, p. 413], *P.* sp. from *Phalaenopsis amabilis*, and *P. colocasiae* from *C. antiquorum* [ibid., xvi, p. 301]. Both leaf surfaces of pepper are readily infected by the mycelium and conidia of the *Phytophthora*, the zoospores of which, however, can only attack the under sides. The typical lesions develop in two to three days; during the night conidia

are formed in profusion on the lower leaf surfaces. Diseased leaves are usually shed before the fungus reaches the petioles.

According to Tucker's system of classification all the pepper strains belong to *P. palmivora* [ibid., x, p. 754], but the strong preference of the fungus under discussion for pepper and its high temperature optimum for growth on potato dextrose agar (31° C.) are considered to entitle it to varietal rank as *P. palmivora* var. *piperis* [of which no Latin diagnosis is given]. In agar cultures oogonia are extremely rare, but these organs may be formed in abundance when the pepper strains are grown in conjunction with other *palmivora* strains on maize meal agar slants. Only amphigynous antheridia have been observed; on oatmeal agar the oospores measure 22 to 34·1 μ in diameter (mean 26·6 μ).

The chief sources of infection by *P. palmivora* var. *piperis* are contaminated soil, water, and diseased plant refuse. Transport by water seems to be the chief mode of conveyance of the fungus, which is most destructive in well-cultivated gardens. Zoospore production is stimulated by the falls of temperature liable to follow heavy tropical rains. Infection is most prevalent in the second half of the west monsoon, when dull, damp conditions maintain the conidia in a viable state throughout the day, whereas direct exposure to the sun during the dry monsoon may even destroy the fungus in the leaves.

Experiments in the west of Borneo have shown that the foot rot of pepper may be partially controlled by fortnightly applications of 1 per cent. Bordeaux mixture, while in the Lampong Residency (south Sumatra) a highly resistant variety known as 'lada belantoeng' has been developed and is now largely superseding the old susceptible types.

In order to minimize the risk of soil infection, a network of shallow drain trenches should be dug, with water pits at intervals to prevent the rain water from running off over the soil surface. When infection occurs in one of the squares isolated by the trenches the soil and the diseased plants should be watered with 5 to 10 l. of a 1 per cent. copper sulphate solution per sq. m., and weeding should be temporarily discontinued to prevent the transmission of the fungus by implements, on the labourers' feet, or by similar means.

Baldacci (E.). **Prime ricerche sulla patogenicità di alcuni Fusarium per le piante di Ricino.** [Preliminary studies on the pathogenicity of some *Fusarium* spp. to Castor Oil plants.]—*Boll. Soc. ital. Biol. sper.*, xii, 3, pp. 105–106, 1937.

Samples of diseased castor oil [*Ricinus communis*] plants examined by the writer at the Pavia Cryptogamic Laboratory yielded *Fusarium scirpi* [*R.A.M.*, xv, pp. 746, 765], *F. moniliforme* [*Gibberella moniliformis*], *F. semitectum* [ibid., xvi, p. 324], and a species of *Verticillium*. Inoculation experiments with pure cultures on Pollacci's medium of *F. semitectum*, *G. moniliformis*, and *G. pulicaris* (*F. sambucinum*) [ibid., xvi, p. 434], the last-named supplied by Wollenweber, gave negative results. However, 9 out of 27 seedlings raised from seeds naturally infected at their apices and kept either in a greenhouse at 27° or under a bell-jar at 20° C. contracted the typical desiccation of the growing points associated with the disease; from three of the

affected plants a *Fusarium* was isolated and from two a *Macrosporium*. Twelve seedlings from the same batch of seed kept in the open remained healthy.

It would appear from these data that the species of *Fusarium* involved in the castor oil disease (the etiology and symptomatology of which are to be further discussed at a later stage of the investigations) are only pathogenic to plants weakened by adverse environmental conditions.

BALDACCI (E.). **Prove di disinfezione dei semi di Ricino.** [Disinfection experiments with *Ricinus* seeds.]—*Boll. Soc. ital. Biol. sper.*, xii, 3, pp. 106–107, 1937.

The treatment of castor oil [*Ricinus communis*] seeds against species of *Fusarium* and *Macrosporium* [see preceding abstract] with 0·25 per cent. Caffaro powder or uspulun (one hour's immersion) resulted in an average germination of 85 and 83 per cent., respectively, compared with 79 per cent. for the untreated controls. The fungi developed on 6 out of 37 of the seedlings from Caffaro-treated seed and on 3 out of 37 in the lot disinfected with uspulun.

STOREY (H. H.). **The introduction of Sugar-Cane varieties.**—*E. Afr. agric. J.*, ii, 5, pp. 390–391, 1937.

The procedure adopted in Tanganyika Territory to regulate the introduction of new sugar-cane varieties so as to minimize the risk of bringing in disease is as follows. Any planter desiring a variety from overseas must write to his Department of Agriculture, who pass on the request to the Central Quarantine Station, Amani, who, in turn, obtain the variety and grow it in the small, isolated quarantine houses. When the material has passed the requisite tests, a process requiring about two years, the applicant is informed. Usually 50 to 100 setts only are available and are issued at a price of 50 cents each, to cover the expenses of quarantine.

MARTIN (J. P.). **Pathology.**—*Rep. Hawaii. Sug. Exp. Sta., 1936* (ex *Proc. Hawaii. Sug. Pl. Ass., 1936*), pp. 28–35, 1937.

In this report [cf. *R.A.M.*, xv, p. 559] it is stated that preserved sugar-cane leaves from Guam showed the presence of rust [*Puccinia kuehnii*: ibid., xi, p. 203], brown stripe [*Helminthosporium stenospilum*: ibid., xvi, p. 206], leaf freckle, and two unknown leaf spots. Banded chlorosis [ibid., xiii, p. 397] was prevalent on H 109 canes on Maui and Oahu during winter, low temperature injuries sometimes causing important losses locally. Chlorotic streak [fourth disease: ibid., xvi, p. 205] was closely associated with nutritional factors, the symptoms sometimes being most pronounced in soils deficient in potassium. Transmission occurred on cuttings, and in certain environmental conditions healthy canes often became affected, but it is considered that favourable growth conditions will much reduce the severity of the disease. Similar symptoms were observed on elephant grass [*Typha elephantina*]. The results of experiments by C. W. Carpenter supported earlier observations that in certain soils phosphorus and calcium increase the resistance of sugar-cane roots to *Pythium* root rot [*P.*

graminicolum: ibid., xiii, p. 471; xv, p. 560]. The better growth of *Panicum barbinode* [*P. molle*] as compared with Sudan grass [*Sorghum sudanense*] in certain growth-failure soils is due to its resistance to *Pythium* root rot. The evidence obtained indicated that a short cropping system reduces the incidence of leaf scald [*Bacterium albilineans*: ibid., xvi, p. 160]; aqueous solutions of sulphurous acid, methylene blue, copper sulphate, and zinc chloride (1 in 100,000) were toxic to the causal organism after 24 hours.

ČERNIK (L.). **Krankheiten und teratologische Missbildungen an Pflanzen der Olmützer Flora.** [Diseases and teratological malformations of plants of the Olmütz flora.]—*Verh. naturf. Ver. Brünn*, lxviii (*1936*), pp. 49–78, 16 figs., 1937.

The following are among the records of phytopathological interest in this annotated list of diseases, pests, and teratological malformations of plants in the Olmütz district of Czecho-Slovakia. Snapdragon [*Antirrhinum majus*] rust (*Puccinia antirrhini*) [see above, p. 515], first observed locally in 1935 [*R.A.M.*, xv, p. 370], spread in 1936 and completely destroyed the plantings in some nurseries and private gardens. A black discoloration of cabbage leaves was found to be caused by *Leptosphaeria napi*. *Clematis jackmanni* was affected by an obscure disorder, involving a black spotting extending over the entire leaf and rapid dying-off of the shoot down to the root-stock. The aecidial stage of *Gymnosporangium juniperinum* was observed on *Sorbus* [*Pyrus*] *aucuparia* [ibid., xv, p. 609]. Various fungi have been implicated in the formation of alder (*Alnus glutinosa*) mycorrhiza, namely, *Schinzia alni* Woron., *Frankia subtilis* Brunch., *F. alni* P. Magn., and *Actinomyces alni* [ibid., xiv, p. 590].

CHUPP (C.) & LINDER (D. H.). **Notes on Chinese Cercosporae.**—*Mycologia*, xxix, 1, pp. 26–33, 1 pl., 1937.

This annotated list of 15 species of *Cercospora* found in China includes *C. cylindrata* n.sp. on leaves of *Dioscorea* sp., *C. leguminum* n.sp. on (?) *Crotalaria* leaves [both with Latin diagnoses], *C. pachyderma* on *Dioscorea* spp., *C. meliae* Ell. & Ev. on *Melia*, with white spots, brown stromata, short conidiophores, and obclavate conidia resembling those of *C. leucosticta* and *C. subsessilis* [ibid., xvi, p. 493], *C. personata* [loc. cit.] on *Arachis*, and *C. snelliana* on *Morus*.

MAIRE (R.). **Fungi catalaunici: series altera. Contribution à l'étude de la flore mycologique de Catalogne.** [Catalan fungi: second series. A contribution to the study of the mycological flora of Catalonia.]—*Publ. Inst. bot. Barcelona*, iii, 4, 128 pp., 8 figs., 1937.

An annotated list is given of the fungi collected by the writer in October, 1933, in Catalonia, including 205 new species and varieties [with Latin diagnoses]. *Coniothyrium lavandulae* n.sp. ad int., found on dead lavender (*Lavandula vera*) leaves, is characterized by subglobose pycnidia, 75 to 140 μ in diameter, producing smooth, chestnut-coloured, shortly ovoid, often subangulate, thick-walled (1 μ) spores, 5 to 6 by 4 to 5 μ. *Sphaeria ceratosperma* is renamed *Valsa ceratosperma* (Fr. ex Tode) Maire comb. nov. (syn. *V. ceratophora*). *Lophodermium*

nervisequum was found on *Abies alba* needles [ibid., v, p. 709] and *L. pinastri* [ibid., xv, pp. 610, 683] on those of *Pinus montana* and *P. pinea*. Witches' brooms are formed on *Quercus ilex* by *Taphrina kruchii* (Vuill.) Sacc.

Codinaea is described as a new genus of the Dematiaceae-Myxotrichelleae allied to *Ellisiella* and *Myxotrichella*, but differing from the former in its elongated, septate conidiophores and capitulate conidia, and from the latter in its simple sterile hyphae, free conidiophores, and ciliate conidia.

Da Camara (E. de S.), de Oliveira (A. L. B.), & da Luz (C. G.). **Mycetes aliquot Lusitaniae. I in Laboratório Pathologiae Vegetalis Instituti Agronomici Olisipponis observata.** [Some fungi of Portugal studied at the Phytopathological Laboratory of the Lisbon Agronomic Institute. I.]—Reprinted from *Rev. agron., Lisboa*, xxiv, 2, 37 pp., 4 pl., 1936. [Received April, 1937.]

Eleven of the species in this annotated list of nearly 100 fungi are new to science and furnished with Latin diagnoses, while a number of other records represent additions to the knowledge of the mycoflora of Portugal [see next abstract]. Onion leaves were infected by *Puccinia allii* [*R.A.M.*, xv, pp. 57, 633], the aecidial and uredospore stages only being observed. The foliage of *Papaver rhoeas* was attacked by *Entyloma fuscum* [ibid., xvi, p. 515] and *Peronospora arborescens* [ibid., xiii, p. 445]. *Buxus sempervirens* leaves were infected by *Hyponectria buxi* [ibid., vi, p. 619]. *Taphrina aurea* was observed on poplar foliage [ibid., xiv, p. 665]. *Urophlyctis alfalfae* attacked the shoots of *Medicago* sp. [ibid., xv, p. 776] and *U. trifolii* the leaves of *Trifolium cherleri* [ibid., vi, p. 123]. Lemon leaves bore irregular, whitish, apical lesions with pale chestnut borders surrounded by a sinuous, blackish-brown line in association with *Macrophyllosticta* (*Phyllosticta*) *citri* n.sp. *M.* (*P.*) *oleae* n.sp. occurred with *Coniothyrium oleae* on ashen-grey spots with prominent, brown margins at the tips of olive leaves. *Sphaeropsis pelargonii* n.sp. was observed on *Pelargonium zonale* shoots. The foliage of *Antirrhinum majus* bore yellowish, purple to brown-edged lesions caused by *Septoria antirrhini* [ibid., xv, p. 683]. *S. gladioli* was detected on *Gladiolus* leaves [ibid., xiv, p. 193]. The light yellowish-brown, depressed-globose, erumpent acervuli, 150 to 250 μ in diameter, of *Gloeosporium evonymicolum* n.sp. were found on *Euonymus japonicus* leaves. *Phleospora rosae* n.sp. forms subcircular to ellipsoid, sometimes confluent, ashen-grey spots, bordered by a blackish-purple zone, up to 2·5 mm. in diameter, scattered over the surface of cultivated rose leaves.

Da Camara (E. de S.). **Contributiones ad mycofloram Lusitaniae XI.** [Contributions to the mycoflora of Portugal. XI.]—Reprinted from *Bol. Agric., Lisboa*, II, Sér. I, i, 88 pp., 100 figs., 1936. [Received April, 1937.]

Twenty-eight of the fungi enumerated in this copiously annotated contribution, comprising nearly 200 records, to the mycoflora of Portugal [*R.A.M.*, xii, p. 725 and preceding abstract] are new to science and are furnished with Latin diagnoses, while a large proportion of the

remainder were hitherto unknown in the country. The ovaries of *Lolium temulentum* were invaded by *Tilletia lolii* [ibid., xii, p. 156]. *Pyrenophora polytricha* n.sp., characterized by black, circular to piriform perithecia, erect, cuspidate, pluriseptate setae, 240 to 320 by 8 to 12 μ, and aparaphysate, oblong to clavate, sessile asci, 135 to 200 by 35 to 64 μ, containing eight elongated to ovoid or slightly claviform, transversely 4- to 6-, mostly 5-septate, straw-coloured ascospores, 46 to 62 by 19 to 24 μ, was found occupying the culms of oats (*Avena sterilis*); its conidial stage, *Helminthosporium olisipponense* n.sp., may be recognized by its simple, multiseptate, flexuous, pale reddish conidiophores, 40 to 90 by 4 to 4·5 μ, bearing more or less fusoid or ellipsoid, 6- to 9-septate, pale tawny conidia, 37 to 65 by 8 to 11 μ. *Podosphaera leucotricha* [ibid., xvi, p. 262] was observed on apricot leaves. The foliage of tea plants was infected by *Macrophyllosticta* (*Phyllosticta*) *unamuniana* n.sp., producing irregular, brown spots with sooty-black borders near the leaf apices, and characterized by pycnidia, 160 to 250 μ, with an ostiole about 40 μ in diameter and by greenish-yellow variable spores, 15 to 30 by 5·5 to 9 μ. Apple leaves were attacked by *Phyllosticta mali* [ibid., xii, p. 330]. *Ceratostomella ulmi* was isolated in pure culture from elm (*Ulmus glabra*) wood from the Lisbon Zoological Gardens [ibid., xiv, p. 264]. Bean (*Phaseolus vulgaris*) leaves were infected by *Isariopsis griseola* [ibid., xiv, pp. 396, 734].

LEACH (R.). **Observations on the parasitism and control of Armillaria mellea.**—*Proc. roy. Soc.*, Ser. B, cxxi, 825, pp. 561–573, 3 pl., 1937.

In studies on *Armillaria mellea* [*R.A.M.*, xvi, pp. 215, 355], which causes serious losses to tea in Nyasaland [ibid., xvi, p. 209], the author states that when germinating tea seeds and 18-month-old tea plants were planted over infected pieces of *Gliricidia maculata* [*G. sepium*] roots, only the seedling roots and new feeder roots from the older plants that came into contact with fresh rhizomorphs developed infection. One month after planting very few of the seedling roots showed penetration, though many had firmly attached rhizomorphs. Some were brown on each side of the rhizomorph, and the cortex of a few was split longitudinally by an internal rhizomorph travelling upwards. After two months the internal rhizomorphs had advanced up and down the seedlings for a total length of 2 to 12 cm.

Penetration occurred as described by Thomas [ibid., xiii, p. 552]. The rhizomorph was attached to the root by a hyphal mat; no hypha entered any cell, and no mucilaginous attachment to the root was apparent. The rhizomorph progressed between the cortex and xylem and sometimes in the pith only, the tip advancing upwards as a massed hyphal unit, individual hyphae growing out from the sides behind. In both healthy and infected seedlings the pith is rich and the cortex poor in starch. In virgin forest only a very small percentage even of a susceptible species is killed by *A. mellea*, but after felling the roots become heavily infected.

As a result of these observations a method of biological control is suggested that aims at preventing the infection of forest tree roots by *A. mellea*. In the infection experiment described above, the fact that hyphae from the internal rhizomorph developed freely in the xylem

and pith and not at all in the cortex of the seedlings indicated that the fungus requires abundant carbohydrate supplies, and this view was supported by cultural studies. The roots of normally felled trees have a high carbohydrate content, but it was thought that if they were depleted of starch before felling by ring-barking to prevent the passage of the carbohydrates to them from the foliage, they would be less susceptible to *A. mellea* and more so to harmless saprophytes such as *Rhizoctonia bataticola* [*Macrophomina phaseoli*] and *Botryodiplodia theobromae*, which develop freely in roots low in carbohydrates.

Evidence in favour of this hypothesis was obtained as follows. The roots of healthy *Parinarium mobola* trees (highly susceptible to *A. mellea*) after felling contain starch, whereas the roots of ringed trees gradually become deprived of it, though remaining healthy until defoliation is complete. Examination of the roots of 24 felled (unringed) *P. mobola* trees showed that 54 were affected by a dry rot, uniformly brown, with an easily separable bark, and bore sclerotia of the *M. phaseoli* type, while 186 showed rot due to *A. mellea*. Six other ringed *P. mobola* trees had roots free from fungi, while 12 others, also ringed, had one (doubtful) case of *A. mellea* infection, with 113 dry-rotted roots. These figures show that the ringing removed the main source of danger to ensuing susceptible crops, and appear to lend strong support to the author's views.

Large-scale ringing experiments have been started but at least three years will be required before the results are available. A schedule will have to be worked out for opening up forest areas. In forests of both resistant and susceptible trees the ringing of the latter might be effected many years before the land is required, provided the number of resistant trees are sufficient to protect the land from denudation, whereas in forests of susceptible trees only it would be necessary to know the least time required by different-sized trees of each species to render the roots susceptible to the innocuous fungi only.

PITTMAN (H. A. J.). **Disinfection of Tobacco seed.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xiv, 1, pp. 93–95, 1937.

Brief directions are given for the disinfection of tobacco seed against seed-borne diseases with mercuric chloride (1 in 1,000), silver nitrate [*R.A.M.*, xv, pp. 61, 777] (1 in 1,000 for 15 minutes), and absolute alcohol (1 lb. per 1 lb. of seed, for 5 minutes), the methods of preparing and using the disinfectants being clearly explained. The alcohol method has the advantage that the treated seed dries very quickly.

PARK (M.) & FERNANDO (M.). **Some studies on Tobacco diseases in Ceylon. I.**—*Trop. Agriculturist*, lxxxviii, 3, pp. 153–168, 2 pl., 1937.

In experiments at the Experiment Station, Wariyapola, tobacco seedlings of Harrison's Special variety were grown in carefully prepared burnt-over beds from untreated seed and seed subjected to 15 minutes' immersion in a 0·1 per cent. solution of silver nitrate [see preceding abstract] (both lots having been carefully cleaned before storage) and sprayed with bouisol [*R.A.M.*, xiv, p. 200 *et passim*] (1 oz. per gall. water) plus agral ($\frac{1}{8}$ oz. per gall.) as a spreader at weekly intervals from the eighteenth day after sowing until transplanting when seven weeks

old. Diseased plants, affected by *Pythium* sp., were removed each day and counted. The sprayed plants from both lots of seed averaged 16·25 damped-off seedlings per unit area as against 288·25 for the unsprayed, this difference being highly significant though the seed treatment exercised no effect on the incidence of the disease.

No frog eye (*Cercospora nicotianae*) [ibid., xv, p. 704; xvi, p. 412] appeared in the nursery beds, demonstrating that by the use of clean, carefully selected seed and by proper preparation of the beds the disease can be avoided. During the sixth week after transplanting counts of 200 leaves taken at random gave means of 37·25 and 30·5 leaves infected with frog eye for the sprayed plants, from sterilized and unsterilized seed, respectively, the corresponding figures for the unsprayed plants being 98·75 and 97·5, respectively. Thus, the effect of spraying on the incidence of *C. nicotianae* was highly significant, but that of seed disinfection was insignificant, the variation between the two factors being subnormal. Infection was not only less prevalent but also less intense on the sprayed than on the unsprayed plants. The distribution of infected plants was uniform and almost always the lowest leaves were the first to be infected. The authors conclude that the main source of frog-eye infection of the newly planted crop is probably from spores perennating in the soil. Air-borne infection does not occur over any considerable distance.

BRAUN (A. C.). **A comparative study of Bacterium tabacum Wolf and Foster and Bacterium angulatum Fromme and Murray.**—*Phytopathology*, xxvii, 3, pp. 283–304, 4 figs., 1937.

Comparative studies were made of the progeny of six single-cell strains of *Bacterium angulatum* and four of *Bact. tabacum* from southern Wisconsin of known pathogenicity to tobacco with a view to determining the possible relationship or identity of the two organisms as suggested by Stapp [*R.A.M.*, x, p. 61].

Attempts to secure differential characters of the two organisms by means of morphological, cultural, physiological, or serological methods gave negative results, greater differences being apparent between the individual strains of the bacteria than between the two types themselves. *Bact. tabacum* showed a tendency to lose its capacity for the secretion of a soluble exotoxin after protracted periods of culture, generally leading to reduction of aggressiveness or invasive power and to the development on the inoculated Havana No. 38 tobacco plants of symptoms comparable to those induced by *Bact. angulatum*. From the evidence available it would seem preferable to regard *Bact. angulatum* as a variety of *Bact. tabacum* rather than to combine the two species under the latter name. Investigations on the control of both diseases should be carried out with *Bact. tabacum*, the presence of which in seed-beds is much more rapidly and certainly established than that of *Bact. angulatum*.

TROTTER (H.). **La 'maculazione ad anello' nelle foglie del Tabacco.** [Ring spot of Tobacco leaves.]—*Boll. tec. Tab.*, xxxiv, 1, pp. 51–60, 6 pl., 1937. [English summary.]

A summary is given of the available information concerning ring

spot of tobacco [*R.A.M.*, xvi, p. 344], an outbreak of which was observed for the first time at Scafati (Salerno) on 4th June, 1934, on a number of oriental varieties in the field. With a rise in temperature, culminating on the 12th, the yellowish or pale green, zonate lesions completely disappeared from the leaves, in which the virus had evidently assumed a latent form. There is reason, however, to suppose that the latent effects of ring spot may persist and cause storage defects [cf. ibid., xv, p. 689]. The disease was again observed on 16th July, 1935, on a limited number of plants of a cross between Platana and Sary Chandasienicz, and on 11th July, 1936, in a mild form on a few Burley plants. In the greenhouse ring spot developed in 1936 on Havana (20th June), Virginia (30th November), and *Nicotiana tomentosa*, a highly susceptible host on which the symptoms appeared in the 'oak leaf' form [ibid., xii, p. 697]. A single plant of *N. tomentosa* among five separated from each other by less than a metre has been severely affected by ring spot for nearly two years without communicating the disease to the rest of the group.

STANLEY (W. M.). **Crystalline Tobacco-mosaic virus protein.**—*Amer. J. Bot.*, xxiv, 2, pp. 59–68, 2 figs., 1937.

In this paper, read before the American Association for the Advancement of Science on 29th December, 1936, and awarded the prize of the Association, the author after briefly reviewing the history of tobacco mosaic investigations, recapitulates and discusses his own researches on the problem [*R.A.M.*, xvi, p. 499] with references to the results obtained by other workers. The conclusion is reached that the protein is itself the virus. A comprehensive bibliography of 72 titles is appended.

LAVIN (G. I.) & STANLEY (W. M.). **The ultraviolet absorption spectrum of crystalline Tobacco mosaic virus protein.**—*J. biol. Chem.*, cxviii, 1, pp. 269–274, 1 diag., 1 graph., 1937.

The ultra-violet absorption spectrum of crystalline tobacco mosaic virus protein [see preceding and next abstracts] has been determined by means of a Spekker spectrophotometer for the extinction coefficients and a small Hilger quartz spectrograph to locate the narrow bands of aromatic amino acids constituting the broad absorption band of proteins with a maximum at 2,650 Å. The present interpretation (admittedly tentative pending the development of a more accurate photometer than is yet available) of the composition of the narrow bands of pepsin is that the one lying in the region of 2,920 Å is due to tryptophane, that at 2,840 Å to tyrosine, the broad region from 2,720 to 2,810 Å results from the overlapping of tryptophane and tyrosine, while phenylalanine is the source of those occurring between 2,500 and 2,700 Å. The virus protein has a well-marked and very persistent tryptophane band, which is apparently in the same position as in the case of other proteins, but the tyrosine band is replaced by a much wider one, shifted towards the ultra-violet and absent from all the other proteins examined.

It was found possible to demonstrate the presence of the virus

protein in the semi-purified juice of mosaic Turkish tobacco plants by means of ultra-violet absorption spectrum measurements.

PRICE (W. C.) & GOWEN (J. W.). **Quantitative studies of Tobacco-mosaic virus inactivation by ultra-violet light.**—*Phytopathology*, xxvii, 3, pp. 267–282, 1 diag., 1 graph, 1937.

The survival values of the tobacco mosaic virus exposed at a distance of 7½ in. to ultra-violet light from a Cooper Hewitt mercury lamp with a spectrum commencing at 2,175 Å and having strong lines at 2,260, 2,285, 2,305, and 2,325 Å and so forth, operated on a direct current of 110 volts, were found to follow a simple exponential curve. Assuming radiant energy to be absorbed in discrete units, this curve may be obtained when one unit of energy absorbed in a virus particle is sufficient to cause its inactivation, the rate of which will depend on the amount of energy proper to the virus. The data show the rate of inactivation to be greatest when the virus is most purified (in a solution of crystalline material) [see preceding and next abstracts] and the solution contains least extraneous matter to absorb the energy. The inactivation rate is lowered by the addition of healthy tobacco plant juice to purified virus. The rate for the crystalline material plus healthy tobacco plant juice is substantially identical with that for the virus in diseased plant juice. The inactivation rate for the virus in non-purified dried juice follows essentially the same curve as that for the wet material, except that a portion of the virus fails to undergo inactivation even after protracted periods of exposure. The latter phenomenon is attributed to the fact that the dried virus particles, by reason of their fixed position, may be overlaid by other material and thus shielded from the ultra-violet rays.

STANLEY (W. M.) & WYCKOFF (R. W. G.). **The isolation of Tobacco ring spot and other virus proteins by ultracentrifugation.**—*Science*, N.S., lxxxv, 2198, p. 181, 1937.

As chemical methods for the isolation of crystalline virus protein [see preceding and next abstracts] were unsuccessful when used with plants affected with the less stable viruses, such as tobacco ring spot, potato latent mosaic, cucumber mosaic, and severe etch, only partial purification and a limited degree of concentration being obtained, the protein from the Turkish tobacco ring spot virus was isolated by ultracentrifuging. The virus being unstable and becoming inactivated at room temperature in one day, the work was done at about 2° C., and the ultracentrifugation performed in a quantity head precooled to about 0°. The virus activity was separated from most of the protein in one ultracentrifugation. Several of the small pellets were combined, suspended in 0·1 M phosphate buffer at P_H 7 and spun on a Swedish angle centrifuge for 15 minutes. The supernatant liquid was then ultracentrifuged, and two repetitions carried out of alternate ultracentrifugation, re-solution of the protein, and low-speed angle centrifugation. The pellet obtained consisted of crystalline protein with a trace of insoluble matter, about 0·005 to 0·01 mg. of protein per gm. of starting material being obtained on each of four occasions. In each of ten tests solutions containing only 10^{-7} gm. of the protein per c.c.

caused necrotic lesions on *Vigna sinensis* [*V. unguiculata*], the protein being approximately 10,000 times more active than the starting material.

In contrast to tobacco mosaic virus protein the ring spot virus protein is almost totally denatured and inactivated after one hour at P_H 3, completely so after 5 minutes at 64°, and is partially and nearly wholly inactivated after 1 and 6 days respectively, at room temperature. It loses only little activity after one hour at P_H 9·6 but is completely denatured and inactivated by one hour at P_H 10·8.

The serological properties of the two proteins are also quite different, the sera of animals injected with tobacco mosaic virus protein giving a precipitate when mixed with solutions containing 10^{-6} gm. of mosaic protein per c.c., but not when mixed with solutions containing even 10^{-3} gm. of ring spot virus per c.c. A sample of ring spot virus containing a trace of tobacco mosaic virus protein was purified by the addition to it of antiserum to mosaic virus protein and removal of the precipitated mosaic virus protein by low-speed angle centrifugation, the ring spot protein being separated from the excess antiserum by ultracentrifugation. Further, the X-ray diffraction pattern of crystalline ring spot virus protein differs from that of mosaic protein. It was therefore possible to isolate from ring spot Turkish tobacco plants a protein possessing the properties of ring spot virus and differing markedly from mosaic virus protein.

The protein in the pellets obtained by this method from Turkish tobacco infected with potato latent mosaic (X virus) was of a single molecular species with a sedimentation constant $S_{20} = c.$ 110, close to that of the ring spot virus protein. In the case of Turkish tobacco infected with severe etch the pellets were larger than those of latent mosaic and contained all the virus activity, the protein sedimenting more diffusely than those of ring spot and latent mosaic. Ultracentrifugation of the juice from Turkish tobacco plants infected with cucumber mosaic gave insufficient soluble protein for physical and chemical tests, although all the virus activity was concentrated at the bottom of the tubes. Attempts to concentrate the juice before ultracentrifugation were unsuccessful.

The data obtained show that high molecular weight proteins are characteristic of these diseases and that the properties and concentration in the host of the proteins differ greatly.

BEALE (HELEN P.). **Relation of Stanley's crystalline Tobacco virus protein to intracellular crystalline deposits.**—*Contr. Boyce Thompson Inst.*, viii, 5, pp. 413–431, 6 figs., 1937.

The author states that by using Stanley's method she obtained crystalline tobacco virus protein [see preceding abstracts] from Turkish tobacco plants affected separately with ordinary tobacco mosaic and Holmes's [*R.A.M.*, xiii, p. 399] attenuated strain, from air-dried mosaic-diseased Turkish tobacco, from White Burley tobacco and *Petunia* sp. plants affected with ordinary tobacco mosaic, and also from *Solanum nigrum* var. *nodiflorum* affected with aucuba mosaic. It was further isolated from Turkish tobacco affected with streak (a combination of potato virus X and tobacco virus); the material

thus obtained appeared to be identical with that isolated from tobacco plants affected with the tobacco virus alone, and when inoculated into *Nicotiana glutinosa* plants produced local lesions characteristic of this virus, but not the systemic infection typical of potato virus X on this host.

A fully illustrated account is given of microscopic studies of the crystalline deposits associated with chlorosis and present in the living mosaic-diseased cells; by adding dilute sulphuric, hydrochloric, acetic, or nitric acid, or saturated magnesium sulphate solutions to the mounts of living diseased tissue, the crystalline plates were transformed into needles in all the hosts tested, namely, the Turkish and White Burley tobacco varieties, *Petunia* sp., tomato, *Capsicum* sp., and *S. nigrum* var. *nodiflorum*. It is suggested that the intracellular crystalline plates may be more complex in chemical composition than Stanley's crystalline tobacco virus protein, and it is concluded that these deposits are the source of the crystalline protein, firstly, because both compounds are present in large amounts; secondly, because of the striking similarity in the gross appearance of the needles precipitated in the cell and those isolated from virus extract; and thirdly, because the acidity and alkalinity at which Stanley reports denaturation of the protein corresponds closely to the reactions at either end of the P_H range at which the intracellular crystals go into solution and are not subsequently recrystallizable. It is further believed that the concentration of the crystallizable material is an important factor in the intracellular crystallization of tobacco virus protein.

Smith (K. M.). **An air-borne plant virus.**—*Nature, Lond.*, cxxxix, 3513, p. 370, 1937.

The virus [of tobacco necrosis] found in the roots of apparently normal tobacco plants in an insect-proof glasshouse [*R.A.M.*, xvi, p. 419] having been observed in the roots of tobacco plants grown in autoclaved soil and watered only with boiled water, the glasshouse air was tested with an apparatus designed by J. P. Doncaster consisting of an electric pump connected by rubber tubing to gas-washing bottles containing a moist cotton-wool pad through which the air was drawn. The cotton-wool was tested for the virus by rubbing on the leaves of French bean (*Phaseolus vulgaris*), and in three separate experiments the virus was isolated from the pads. The smallest quantity of this air-borne virus reaching the soil seems capable of entering the roots of a plant growing therein.

Hirayama (S.) & Yuasa (K.). **Occurrence of inclusion bodies in the guard cells of the stomata of mosaic-tobacco plants.**—*Ann. phytopath. Soc. Japan*, vi, 4, pp. 305–306, 2 figs., 1937. [Japanese summary.]

Contrary to Miss Sheffield's statement that the cell inclusions typical of certain virus diseases do not occur in the guard cells of the stomata [*R.A.M.*, xvi, p. 67], the writers' renewed observations on fresh tobacco mosaic material mounted in acetocarmine definitely disclosed the presence of such bodies in the site in question [ibid., xv, p. 322]. After about an hour the structures are liable to obliteration under the

influence of the acetic acid, and it is thought that Miss Sheffield's cytological technique may possibly have induced this process at an earlier stage before the nature of the inclusions could be recognized.

COCHRAN (W. G.). **The statistical analysis of field counts of diseased plants.**—*J.R. statist. Soc., Suppl.*, iii, 1, pp. 49–67, 1 diag., 1936.

This is a discussion of the statistical analysis of the data obtained by the regular examination of every plant in a field or greenhouse for symptoms of a particular disease—in this case spotted wilt of tomatoes investigated by J. G. Bald at the Waite Institute, Australia [*R.A.M.*, xvi, pp. 134, 345, 497]. The analysis of the data at the first count (18th December, 1929, the 1,440 tomatoes having been planted out on 26th November) revealed a tendency towards a gradient of infection across the field and to the congregation of diseased plants in small patches. These results are both compatible with the transmission of the disease by *Thrips* [*tabaci*]. Patchiness would be explicable by the superior attractiveness or accessibility to the insects of certain sections of the field, or alternatively, to the migration of the viruliferous individuals to adjacent plants after feeding. In the second count (31st December) the indications of patchiness were very slight, and there was no pronounced irregularity in the distribution of the infection percentage over the field.

BERKELEY (G. H.). **Prevention of virus diseases of greenhouse grown Tomatoes.**—*Circ. Dep. Agric. Can.*, 118, 7 pp., 7 figs., 1937.

Virus diseases of tomato, particularly common mosaic and single-virus and mixed-virus streaks, are stated to cause considerable losses throughout Canada, the first-named reducing the yield by up to 20 per cent. in the St. Catharines district of Ontario [*R.A.M.*, xvi, p. 348]. Other types of mosaic common on tomato are the yellow (aucuba), potato (mottle), and cucumber. Spotted wilt [see preceding abstract] has only been reported on one or two occasions. The common mosaic virus has been found to remain viable in the soil at St. Catharines for two to three months after harvesting. Recommendations for control include soil sterilization by steam or formaldehyde, crop rotation, strict plant sanitation, with disinfection of the hands and implements after handling infected plants, and frequent fumigation of the houses against insects.

LANGFORD (A. N.). **The parasitism of Cladosporium fulvum Cooke and the genetics of resistance to it.**—*Canad. J. Res.*, xv, Sect. C, 3, pp. 108–128, 3 pl., 1 fig., 1937.

Four physiologic races of *Cladosporium fulvum* [*R.A.M.*, xvi, p. 70] were experimentally differentiated by differences in the pathogenicity of various cultures, while extensive cultural studies showed the presence of an indefinite number of such races. Saltant strains were isolated from cultures arising from single unicellular, uninucleate spores and are therefore regarded as due to mutations. Reaction to infection fell into four main classes, i.e., complete susceptibility, two types of partial resistance, and immunity. Reaction of pure lines of the host to the parasite is plastic and affected by environmental conditions. The

failure of Stirling Castle tomatoes to show inherent resistance to race 1 during midwinter at Toronto was found to be chiefly due to the plants receiving insufficient light at this time, while the inability of the same variety to support sporulation under the experimental conditions was due to the low relative humidity prevalent in the greenhouse. In addition to the dominant factor for immunity the red currant tomato (*Lycopersicum pimpinellifolium*) carries an independently segregating dominant factor which in the absence of the immunity factor governs resistance to the four races of *C. fulvum*. The resistance of Stirling Castle to races 1 and 3 was found to be due to another dominant factor. Among the genetic factors in the host modifying the reaction types is the recessive lutescence factor in the homozygous condition; this factor induces on genetically immune individuals the development of small infection spots which cease to enlarge soon after the symptoms appear. The conflicting reports concerning the reaction of tomato varieties to *C. fulvum* may be explained by failure to relate the results to specific physiologic races, and to the plasticity of the reaction between pure lines of the host and the parasite.

WRIGHT (E.). **Deciduous-seedling disease in midwest nurseries.**—*Plant Dis. Reptr*, xxi, 4, pp. 80–81, 1937. [Mimeographed.]

During the past two years *Rhizoctonia* [*Corticium*] *solani* has been isolated from the following deciduous seedlings attacked by root rot and damping-off in Federal nurseries in the middle-west states of North America; *Acer saccharinum*, *Catalpa speciosa*, *Ulmus pumila*, *U. americana*, *Chilopsis linearis*, *Robinia pseud-acacia*, *Caragana arborescens* (root rot only), and from seedlings of *Fraxinus pennsylvanica* var. *lanceolata* with top blight. Soil inoculation tests showed most isolates to be pathogenic. A *Pythium*, the specific identity of which has not yet been determined, was isolated from seedlings of *U. americana*, *U. pumila*, *C. speciosa*, and *R. pseud-acacia* affected by damping-off.

In a paragraph (p. 82) appended by B. S. Crandall, *Rhizoctonia* is stated to have been isolated during the past three years from seedlings of *R. pseud-acacia*, mimosa [*Leucaena pulverulenta*], hop hornbeam [*Ostrya* sp.], and tulip poplar [*Liriodendron tulipifera*].

KLEBAHN (H.). **Untersuchungen über Chondroplea populea (Dothichiza populea Sacc. u. Br.).** [Investigations on *Chondroplea populea* (*Dothichiza populea* Sacc. & Briard).]—*Z. PflKrankh.*, xlvii, 1, pp. 38–52, 6 figs., 1937.

Positive results were obtained in four out of twelve of the author's inoculation experiments in 1933 through wounds on *Populus alba*, *P. canadensis*, *P. italica*, and *P. robusta* with conidial suspensions of *Chondroplea* (*Dothichiza*) *populea* [*R.A.M.*, xvi, p. 5] from *P. robusta* branches at a Münster (Westphalia) nursery, where 1,500 three-year-old trees were killed by the fungus in 1933, but further experiments in 1934 and 1935 were entirely negative. This low percentage of successful inoculations is noteworthy in view of the severely parasitic character of the organism in nature and indicates that wounding is not the sole prerequisite condition for infection, some other factor, as yet unknown, being apparently involved. The fungus produces sunken, grey lesions

on the cortex, the presence on which of scattered protuberances, 1 to 2 mm. in diameter, provided with a small apical aperture, denotes the occurrence below the epiderm of conidial layers.

Pure cultures of *C. populea* from conidia were readily secured on salep or Sabouraud's agar; a fairly dense mycelium was produced, composed of hyphae 3·4 to 4·5 μ in diameter, with a few isolated swollen, thin-walled elements, 10 to 13 μ in diameter, resembling conidia but definitely distinct from them and possibly corresponding to Voglino's 'loculi' (*Ann. Accad. agric. Torino*, liii, 1910). Pycnidia containing long conidiophores are formed in conidial stromata. No connexion could be detected between *C. populea* and *Cenangium populneum* [*R.A.M.*, xv, p. 471] in comparative studies on herbarium material.

BEDWELL (J. L.). **Factors affecting Asiatic Chestnuts in forest plantations.**—*J. For.*, xxxv, 3, pp. 258–262, 1937.

In connexion with a survey from 1930 to 1933 of the Chinese and Japanese chestnut (*Castanea mollissima* and *C. crenata*) plantings established within the area bounded by New Hampshire, Texas, Iowa, and Florida, it is mentioned that neither species is absolutely immune from blight (*Endothia parasitica*) [*R.A.M.*, xv, p. 692], though both are highly resistant on good sites under favourable growing conditions. The disease does not usually attack trees under four years old, and in the plantings inspected by the writer deaths from blight occurred in nine localities, at only two of which did the mortality rate equal 0·5 per cent. of the total number planted.

KALSHOVEN (L. G. E.). **De ziekten en plagen van den Rasamala.** [Rasamala diseases and pests.]—*Tectona*, xxx, 3, pp. 162–176, 2 figs., 1937.

This is a compilation of the available knowledge concerning the fungal diseases and insect pests of 'rasamala' (*Altingia excelsa*), stated to be one of the most valuable trees of western Java. The following fungi have been observed: *Rigidoporus microporus* [*Fomes lignosus*] causing white root rot, damping-off (*Rhizoctonia*) [*Corticium solani*], a white, cobweb-like coating of the trunks (*Marasmius* sp.), and a die-back of the branches, accompanied by resin exudation, associated (possibly in a secondary capacity only) with *Diplodia* sp. and *Pestalozzia guepini*.

MEIER (K.). **Über eine durch Kalimangel bedingte 'Gelbsucht' an Thujapflanzen.** [On a 'yellowing' of *Thuja* plants induced by potash deficiency.]—*Landw. Jb. Schweiz*, li, 3, pp. 297–304, 4 pl. (2 col.), 1937. [French summary.]

A pathological condition of *Thuja* plants in Swiss nurseries manifested by zonate chlorosis, or in more severe cases by a reddish-brown to brown discoloration of the foliage and stunting or shedding of the young shoots, was ascertained by soil analysis to be due to a deficiency of potash, the content of which in the ash of affected material amounted to only 3·61 to 3·85 per cent. compared with 7·25 to 8·33 per cent. in that of healthy shoots. Experiments showed that the disturbance may be rectified by the application to the soil of appropriate quantities of

30 per cent. potash salt, while the development of the plants was also favoured by nitrogenous fertilizers.

HEPTING (G. H.) & DAVIDSON (R. W.). **A leaf and twig disease of Hemlock caused by a new species of Rosellinia.**—*Phytopathology*, xxvii, 3, pp. 305–310, 2 figs., 1937.

A leaf and twig disease of hemlocks (*Tsuga canadensis*), apparently identical with that recorded by H. H. Graves in 1914 (*Phytopathology*, iv, p. 63) as affecting three trees of the same species in the southern Appalachians, was prevalent in 1935 in coves in the Pisgah National Forest, North Carolina, causing up to 80 per cent. defoliation among trees under 15 ft. in height. The symptoms are generally similar to those induced on western conifers by *Herpotrichia nigra* and *Neopeckia coulteri* [*R.A.M.*, ix, p. 75]. The needle-bearing parts of the twigs become covered with a dense, greyish-brown mycelial mat in which perithecia are produced in abundance on the lower twig surfaces and leaf bases. After the death of the leaves the mycelium loses its felty, cobweb- or mould-like aspect and becomes flattened against the substratum, to the surface of which the perithecia appear to be glued.

The causal organism is a new species of *Rosellinia*, *R. herpotrichoides*, English and Latin diagnoses of which are given. The small, carbonaceous, rugose perithecia, embedded in the subiculum, are furnished with papillate ostioles, 0·5 to 0·9 mm. in diameter; the short-stipulate, cylindrical asci, 185 to 210 by 11 to 14 μ, with a thickened, gelatinous apical pore, contain eight uniseriate, dark brown, unicellular, ovate-oblong, inequilateral, sometimes slightly apiculate ascospores, 23 to 26 by 9 to 10 μ. No inoculation experiments were carried out, but the parasitic character of the fungus does not appear to be in doubt.

BAVENDAMM (W.). **Erkennen, Nachweis und Kultur der holzverfärbenden und holzzersetzenden Pilze.** [Recognition, detection, and culture of wood-staining and wood-destroying fungi.]—*Handb. biol. ArbMeth.*, Abt. XII, ii, 7, pp. 927–1134, 45 figs., 2 graphs, 1936.

An exhaustive critical survey, followed by a 15-page bibliography, is given of the available information on the macroscopic recognition of fungal diseases of wood on the living tree, felled logs, or structural timbers, the microscopic and chemical methods of detection of infection, and the isolation in pure culture of wood-staining and wood-destroying fungi.

RENNERFELT (E.). **Undersökningar över svampinfektionen i slipmassa och dess utveckling däri.** [Studies on the fungal infection of ground wood pulp and its development therein.]—*Svenska SkogsvFören. Tidskr.*, xxxv, 1, pp. 43–159, 12 figs., 1937. [English summary.]

This is an exhaustive, fully tabulated survey of the writer's studies on the fungal blueing of ground wood pulp in Swedish paper mills. The organisms isolated from the infected material were cultured on glucose or malt agar. The most frequent agents of blue stain, both in newly manufactured and stored pulp, are *Cadophora fastigiata* and *Pullularia pullulans* [*R.A.M.*, xv, p. 271]. Other organisms encountered were *Ophiostoma* [*Ceratostomella*] *piceae*, *Discula pinicola* [ibid., xiv, p. 274], *Phoma lignicola* n.sp. [with a Latin diagnosis], charac-

terized by a greyish-green to greenish-black mycelium, with hyphae up to 8 μ in diameter, round to oblong, dark brown pycnidia, 100 to 250 (usually 150 to 200) μ in diameter, furnished with one, two, or occasionally several ostioles, through which a large number of unicellular, hyaline, oval or slightly flattened, biguttulate spores, 3·5 to 5 by 1·8 to 2·2 μ, are discharged; *Alternaria humicola* [ibid., xii, p. 656; xiv, pp. 249, 270], *C. richardsiae*, *Cladosporium elatum*, *C. herbarum*, *Haplographium penicillioides*, *Oidiodendron fuscum*, *O. nigrum*, *Rhinocladiella atrovirens* [ibid., xiv, p. 275], *Stemphylium botryosum* [ibid., ix, p. 185], *S. macrosporoideum*, and *Trichosporium heteromorphum* [ibid., xiv, p. 275] (very common). There were also a number of Torulopsidaceae, namely, *Rhodotorula glutinis*, *R. mucilaginosa*, *R. gracilis* n.sp. [with a Latin diagnosis], forming round to ovate cells, 5 to 7 by 2·5 to 4 μ, singly or in groups of two to three, and assimilating glucose, maltose, saccharose, galactose, lactose, potassium nitrate, asparagin, ammonium sulphate, and urea; *Torulopsis stellata*, *T. aeria*, *Mycotoruloides* sp. A, *Geotrichoides* sp. A, and *Geotrichum candidum* [loc. cit; xv, p. 673]. Other fungi capable of inducing or increasing discoloration are *Aspergillus flavus*, *A. fumigatus*, *A. niger*, *Paecilomyces varioti* [ibid., xvi, p. 4], *Papulospora sphaerosperma*, *Penicillium amethystinum*, *P. corymbiferum*, *P. flavo-glaucum*, *P. rugulosum*, *P. viridisdorsum*, *Trichoderma koningi* [see above, p. 558], and *T. lignorum* [see above, p. 556].

Sources of infection include the wood itself, fresh water, the air, and the backwater, the last-named being the most important. Newly manufactured pulp from a closed system is more liable to blueing than that from an open one [ibid., xiv, p. 545], and the same applies to material prepared from fresh, as opposed to river-floated wood [ibid., x, p. 216]. Frozen pulp is more susceptible to staining after thawing than unfrozen [ibid., xv, p. 271]. The blueing fungi are in general more resistant both to high and low temperatures than the Torulopsidaceae, possibly on account of the low moisture content of their spores. In laboratory experiments only *Pullularia pullulans* and *Trichosporium heteromorphum* multiplied by budding during 48 hours at 1°, 20°, and 35°, chiefly at the medium temperature.

Discussing the problem of control, the writer alludes to Melin's statement that the Torulopsidaceae are capable of exerting an inhibitory action on the activities of the blueing fungi [ibid., xiv, p. 275]. This observation was confirmed to some extent by the writer's tests, but it has also been shown by various workers that the group in question may form mould-promoting substances, and, furthermore, the numbers of the Torulopsidaceae are depleted during winter storage, so that the utility of these organisms cannot be guaranteed. As regards hygienic measures, the main difficulty lies in the reduction of infection in the circulating backwater, the temperature of which should probably approach the upper critical limit, 45° to 50°, while sludge formation may be diminished by the substitution of iron pipes and sheets for copper ones and other technical improvements. Runbäck (*Skogen*, xx, 1933; *Svenska Flottledsförb. Årsb.*, x, 1936) has devised a method of watering or sprinkling stocks of wood which might be introduced into paper mills with advantage.

Destructive Insect and Pest Acts, England. The Fruit Tree Pests (East Sussex) Order of 1936. Dated October 29, 1936. No. 1165 of 1936.—4 pp., 1936.

This Order, effective as from 1st December, 1936, and concerned with the control of fungal diseases and insect pests of fruit in East Sussex, is on similar lines to those already issued to other local authorities [*R.A.M.*, xv, p. 831].

GRADOJEVIĆ (M.). **Yugoslavia: on the products used in the control of plant diseases and pests.**—*Int. Bull. Pl. Prot.*, xi, 3, pp. 51–52, 1937.

Any person desirous of manufacturing, introducing, or placing on the market an insecticidal or fungicidal product or the like must address to the Jugo-Slavian Ministry of Agriculture a special application, specifying the name of the preparation, describing in detail its properties, defining its active principle, stating whether it is or is not toxic to human beings and livestock, and indicating the method of use, dosage, and other particulars. Sufficient quantities of the product must be placed at the Ministry's disposal for chemical analyses and laboratory and field tests at two experiment stations at least. In the event of satisfactory results from such trials, a temporary permit is issued for the manufacture, import, or sale of the preparation in question, to be replaced by a permanent authorization after three to five years if practical evidence of the efficacy and utility of the treatment is forthcoming.

GOETZ (O.). **Das Reichspflanzenschutzgesetz.** [The Reich Plant Protection Act.]—*Obst- u. Gemüseb.*, lxxxiii, 3, p. 35, 1937.

The German 'Act for the Protection of Economic Agricultural Plants' of 5th March, 1937, falls into four parts, of which (1) empowers the Minister of Food and Agriculture to take the necessary measures [which are summarized] for (*a*) the control of diseases and pests of economic agricultural plants or parts or products thereof, (*b*) the prevention of their conveyance from one part of Germany to another or into the country from abroad or vice versa; (2) is concerned with the organization of plant protection, which is vested in the Biological Institute in co-operation with local plant protection bureaux, to be established by the Reich farmers' leader (Bauernführer) under the Ministry of Food and Agriculture, and with the inspection service, charged with the supervision of the import, transport, and export of plants and plant materials, of nurseries, horticultural, viticultural, and seed selection establishments, and with the provision of health certificates; (3) defines the duties and rights of the persons affected by the application of the regulations; and (4) deals with the expenses of administration, the imposition of fines or other penalties, and the dates of enforcement of the various provisions of the Act.

United States Department of Agriculture. Bureau of Entomology and Plant Quarantine. Service and regulatory announcements, October-December, 1936.—pp. 181–205, 1937.

Summaries are given of the plant quarantine import restrictions in force in Germany, Great Britain, Trinidad and Tobago, the Virgin Islands, Finland, and Bulgaria.